UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Research Administration
Bureau of Plant Industry, Soils, and Agricultural Engineering

THE NATIONAL POTATO-BREEDING PROGRAM
1950

* * * * * * * *
* * * * * * *
* * * * *
* *
*

By

Division of Fruit and Vegetable Crops and Diseases
and
the State Cooperators

* * * * * * * *
* * * * * * *
* * * * *
* *
*

(Twenty-first Annual Report to Cooperators)

Plant Industry Station
Beltsville, Md.

March 16, 1951

TABLE OF CONTENTS

NATIONAL POTATO-BREEDING PROGRAM, 1950

By F. J. Stevenson

This is the twenty-first annual report of the National Potato-Breeding Program to cooperators. It is the largest and, in my opinion, the best one up to the present time. In many instances project outlines are given, indicating the objectives of the work covered in the report. In many cases not only the yields but the specific gravity of the varieties are reported. The data show the extreme effects of environment on this character.

The highest specific gravities are to be found in the report of John G. McLean, Aberdeen, Idaho. The conditions there seem to favor the production of high dry matter. It has been taken for granted that the high dry matter usually found in Russet Burbank grown in Idaho was due to the variety, but many varieties were higher in specific gravity than the Russet Burbank, as a glance at the Idaho tables will show. Noordeling, with a dry-matter content of nearly 30 percent and about 24 percent starch, was the highest. This is a variety we introduced because it showed a degree of field resistance to leaf roll, but so far it has not blossomed under our conditions so has been useless as a parent. Other of the high-starch producers we have used but the poor shapes and yellow flesh in the progenies give very few from which to select. More work needs to be done and is being done on high dry-matter content. See the work of O. C. Turnquist in the report of Krantz et al. from Minnesota.

The dry-matter content in Maine was not so high and varied from place-to-place, as can be seen from Maine (Libby) table 1. Even the Green Mountain and the Irish Cobbler were not as high as is to be expected. Some yields were extremely large, but one is led to ask whether or not the growers are sacrificing dry-matter content for large yields.

Late Blight

More States are becoming interested in resistance to late blight, and the time will come when it will be difficult to release a new variety that does not show resistance. In some States, such as Maine, varieties like Kennebec that are virtually immune from the common forms of late blight can be grown without fungicide (see Lombard and Akeley report), but with a few sprays of an insecticide. However, in other States, like West Virginia and Maryland, spraying with a fungicide paid dividends. It may be that early blight accounts for most of the difference. Dr. Dykstra who has charge of the breeding work in the southern region is of the opinion that for the best results in the South resistance to early and to late blight must be combined.

The work of recombining the genes for immunity from late blight found in demissum is under way at several stations, and varieties resistant to the known physiologic races should before long be ready for release to growers.

Interesting studies are under way at the Minnesota Station dealing with physiologic races and adaptation. (See Eide et al.).

Scab

Scab tests are being conducted at a number of stations, but because of complex inheritance, environment, and physiologic races progress in the development of good scab-resistant varieties has been slow. Rieman sums up his report with the statement: "These results emphasize the complexity of the inheritance of scab resistance in the potato," and all of us who are working with the problem will agree.

Verticillium Wilt

The problem of verticillium wilt seems to be increasing in importance. It has been evident in some fields in Maine, in the South, in sections of California, and in relatively large areas in Idaho and Washington.

The report from Idaho by John G. McLean shows that this disease is probably the limiting factor in potato production on the Egin Bench near Rexburg, Idaho. It is encouraging to note that when the crop of Russet Burbank in the field had been matured by the disease, Menominee, Sequoia, Saranac, and others were relatively unaffected. Sequoia yielded more than 900 bushels per acre in comparison with Russet Burbank late-planted, which yielded about 325 bushels. In addition, Sequoia had a higher dry-matter content than Russet Burbank; perhaps because Russet Burbank was killed so early by the disease. It is interesting to note in the report of Glen Davis (California) that a number of varieties showed no infection. Menominee, one of those showing a high degree of resistance in Idaho, showed resistance at Hollister, Calif.

Ring Rot

The report of Bonde and Merriam shows progress in breeding for resistance to ring rot. It is to be noted that ring rot resistance and resistance to late blight have been combined in a number of seedling varieties. Interesting results on this problem are also found in the Wyoming report.

Virus Diseases

The breeding behavior of immunity from virus A is not too complex, consequently hundreds of seedling varieties have been produced with an immune reaction to virus A. The same can be said for immunity from virus X. On the other hand, resistance to virus Y is difficult to find. Immunity from viruses A and X has been combined with resistance to late blight, as well as with resistance to leaf roll and common scab. Crosses have been made with a number of foreign introductions that are supposed to have field immunity from virus Y. These may help in the production of varieties resistant to this virus.

Leaf Roll

The report of Simpson and Bonde is very encouraging. They say: "It is interesting to note that only five crosses were completely eliminated in 1950. Of the seedlings tested 13.6 percent failed to show current-season symptoms of leaf roll. This is the best showing to date". On the other hand, see the report of Folsom and Merriam. They say: "The low yield rates, together with the variety of leaf roll resistance and the poor cooking quality of many resistant seedlings (see Folsom's section of this report) confirm the impression that for a long time to come leaf roll control will be dependent upon measures other than resistance."

New Varieties

Two new varieties, Pungo and Cherokee, have been released. Pungo (B76-43) was released jointly by the United States Department of Agriculture and the Virginia Truck Experiment Station. It is immune from the common physiologic races of late blight in tests in Maine. The tuber shape is somewhat like that of Sebago but usually rougher. They compare favorably with Green Mountain tubers and are not as rough as those of Irish Cobbler. It has outyielded the Irish Cobbler in several tests in Virginia. Its high yield and blight resistance may make it suitable for the fall or spring crop of Virginia.

Cherokee (B61-3) seems to be adapted to muck-land production in the North-Central States. It was released by the United States Department of Agriculture and the Iowa and Indiana Agriculture Experiment Stations. It is highly resistant to both late blight and scab. Its maturity is mid-season, about 10 days later than Cobbler. It has produced high yields and a high percentage of U.S. No. 1 potatoes in trials on muck soil. In Iowa during a 3-year period Cherokee produced an average of 566 bushels per acre of U.S. No 1 potatoes compared with 461 bushels for Cobbler. In Indiana it yielded 30 percent higher than Cobbler. It has good cooking quality. In Iowa in 3 years of testing it had a higher specific gravity than Cobbler. It has a tendency under adverse conditions to produce second growth. It is not perfect but it may make some money for the muck-land growers until a better variety is produced.

Future Release

Many varieties have been produced that are immune from virus A and X but none so far has been released to growers. Several have been produced that are very good. One of the best is B606-67. It is immune from virus A in field and grafts; that is, in grafts the vine shows necrotic spots but the virus has not yet been recovered in the tubers. It is immune also from virus X, and nearly immune from the common races of late blight. Sometimes non-fruiting lesions appear on its leaves. It produces high yields with relatively high specific gravity. Its tuber shape is not all that is to be desired, but it compares favorably with Green Mountain in this respect.

Many other interesting results are to be found in the report, but it would take up too much space to summarize them all here.

PLANT INDUSTRY STATION (Beltsville, Md.) and CHAPMAN and AROOSTOOK FARMS (Presque Isle, Maine)

By F. J. Stevenson, R. V. Akeley, and E. S. Schultz

Plant Industry Station

The work at the Plant Industry Station was a continuation of that reported in the breeding report for 1949: Producing seed of new crosses and selfed lines; growing seedlings in the greenhouse; distributing potato seed, varieties, and seedlings to cooperating State agricultural experiment stations and to foreign countries; testing seedlings for immunity from virus X; testing others for resistance to black leg; and still others for resistance to various physiologic races of Phytophthora infestans. Data and reports of various kinds were assembled and analyzed, and an annual report was prepared and distributed to all cooperating agencies that sent in reports and to a few other persons who are particularly interested in the project.

Seed Production

In 1950 conditions for seed setting in the greenhouse at Beltsville, Md., were again favorable. Many hand pollinations resulted in an abundance of seed but attempts to make some desirable crosses and species hybrids resulted in failures. Special techniques with slight variations from those used in 1949 were of little or no help. It can be reported again that the best technique so far adopted is to select the self-fertile varieties and seedlings in the field. Varieties that set seed open pollinated in Maine have never failed to produce viable pollen in the greenhouse at Beltsville. An abundance of seed was obtained in 1950. Many attempts were made to make crosses between Solanum polyadenium and cultivated varieties but so far no seed has resulted. Crosses between some of the other species and tuberosum are not too difficult.

New Seedlings

In 1950 more than 50,000 seedlings were grown at the Plant Industry Station, Beltsville, Md. These will be distributed to various stations.

Distribution

The distribution of seed, new seedlings, and named and numbered varieties is given in P. I. tables 1 to 4. The seed and new seedlings that are distributed are produced for the most part at the Plant Industry Station. The named and numbered varieties are grown on the Chapman or Aroostook Farm, Presque Isle, Maine, and are either sent to Beltsville for distribution or distributed directly.

Foreign Introductions

Tubers of 2 varieties of Solanum andigenum and seed of 4 other varieties of the same species were received from H. M. Racicot, Ottawa, Canada. Thirty-four blight-resistant selections were received through the Division of Plant Exploratio and Introduction, from Dr. Wilhelm Rudorf, Max-Planck Institute, Voldagsen, Germany. These selections were grown in quarantine at Glenn Dale, Md., and released to the Division of Fruit and Vegetable Crops and Diseases. From 3 to 10 small tubers of each selection were released. These will be increased and sent

upon request to any of the cooperators who are breeding for resistance to late blight. Eight varieties were received from Von Kameke, Bostlingen Post, Bockhorn uver Walsrode, Germany. As requested by Mr. Kameke, a few tubers of each of these varieties were sent to Dr. John Bushnell, Wooster, Ohio, and Fred Meyer, Madison, Wis.

P.I. table 1. Distribution of potato seed to foreign countries and to State experiment stations in 1950.

Country or State station	Cooperator	Pedigrees
		No.
Africa (Algeria)	P. Lamont	15
Cuba	M. M. Tamargo	4
Egypt	M. S. Attia	20
Puerto Rico	B. G. Capo	13
California	K. G. Swenson	1
Louisiana	T. P. Dykstra	20
North Dakota	Harold Mattson	47

P. I. table 2. Distribution of new seedlings from greenhouse at Beltsville, Md., in 1950.

Station	Cooperator	Progenies	Seedlings	Kind of test - resistance to
		No.	No.	
Idaho	John G. McLean	100	10,220	Adaptation and verticillium wilt.
Iowa	C. E. Peterson	42	3,775	Scab and late blight.
Louisiana	T. P. Dykstra	39	4,485	Scab; early and late blight.
Maine	Reiner Bonde	18	3,464	Ring rot.
Maine	G. W. Simpson	65	10,151	Leaf roll.
Maine	Robert V. Akeley	162	29,429	Scab, blight, and viruses.
Ohio	J. P. Sleesman	31	2,638	Adaptation, hopperburn.
West Virginia	K. C. Westover	12	1,017	Adaptation, etc.

P. I. table 3. Distribution of named and numbered varieties of potatoes to foreign countries.

Country	Cooperator	Named or numbered varieties
		No.
Argentina	D. R. Pasquale	2
Australia	P. Horndrock	1
Australia	C. K. Vears	1
Belgium	Roger Coustry	51
Canada	N. Shenderevich	1
Chile	A. Montaldo	35
Cuba	M. M. Tamargo	6
England	W. C. Moore	7
Germany	Wilhelm Rudorf	8
Germany	Alfons Eichinger	8
Germany	Von Kameke	25
Iceland	Bjorn Johannesson	36
India	Division of Botany	40
Netherlands	H. T. Wiersema	20
New Zealand	R. G. Robinson	10
Peru	E. A. Rafael	10
Puerto Rico	Marco A. Tio	4
Sweden	A. Akerman	3

P. I. table 4. Distribution of named and numbered varieties to States and territories.

State	Cooperator	Named or numbered varieties
		No.
Alabama	C. L. Isbell	12
California	Claude Botkin	1
California	Glen N. Davis	231
Colorado	W. C. Edmundson	25
Connecticut	Arthur Hawkins	12
Delaware	E. P. Brasher	26
Florida	W. A. Hills	21
Florida	F. S. Jamison	8
Florida	A. H. Eddins	9
Idaho	John G. McLean	86
Indiana	N. K. Ellis	45
Iowa	C. E. Peterson	5
Kansas	Claude L. King	5
Louisiana	T. P. Dykstra	153
Maryland	R. A. Jehle	17
Massachusetts	Ralph Donaldson	12
Minnesota	David Thurston	2
Minnesota	M. J. Thompson	4
Michigan	E. J. Wheeler	8
Michigan	T. C. Weidenhamer	1
Michigan	J. F. Crum	1
Montana	M. M. Afanasiev	3

P. I. table 4, continued.

State	Cooperator	Named or numbered varieties
		No.
New Jersey	John C. Campbell	7
New York	William Stemple	41
New York	S. M. Tuthill	1
New York	Fred T. Van Dyck	1
New York	E. V. Hardenburg	11
New York	F. M. Blodgett	22
New York	J. R. Livermore	5
New York	Donald Reddick	7
New York	W. E. Humphrey	1
New York	F. C. Steward	13
New York	L. C. Peterson	65
New York	W. C. Kelly	593
North Carolina	Fred D. Cochran	7
North Dakota	Harold Mattson	9
Ohio	J. P. Sleesman	25
Pennsylvania	R. E. Hartman	26
Pennsylvania	J. Stanley Cobb	11
Pennsylvania	Ralph Iobst	3
Pennsylvania	Wise Potato Chip Co.	15
Pennsylvania	Henry Phipps Institute	13
Rhode Island	T. E. Odland	25
South Carolina	W. M. Epps	6
South Dakota	L. T. Richardson	1
Virginia	Flood S. Andrews	13
Virginia	M. M. Parker	29
Virginia	A. W. Nottingham	1
Washington	Paul A. Wessler	1
Washington	C. L. Vincent	1
Washington	Ralph Roffler	1
Washington	S. B. Locke	50
Wisconsin	H. M. Darling	1
Wisconsin	S. S. Mathisen	1
Wisconsin	J. G. Milward	1
West Virginia	J. G. Leach	87

Chapman Farm, Maine

In 1950, 25 named and numbered seedling varieties were increased on the Chapman Farm; 2,096 seedlings were grown in 10-hill rows and 29,429 in single hills. The latter were grown from true seed to mature tubers in the greenhouse at Beltsville, Md., in the fall of 1949. Of the single-hill tubers 97.6 percent germinated. When planted in Maine about 7.9 percent of those that grew were selected for various tests in 1951. P. I. table 5 gives a summary of the selections made from the single hills and the number intended for each test in 1951.

P.I. table 5. A summary of seedlings grown in single hills on the Chapman Farm in 1950, showing the number of progenies, the number of seedlings planted, the number that produced plants, the number of selections made, and the number intended for the various tests in 1951.

Seedlings			Selections to be tested in 1951								
Planted	Grown	Selected	Late blight	Scab	Ring rot	Virus X	Virus A	Virus Y	Black leg	Verticillium wilt	Leaf-roll and others
No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
29,429	28,739	2,278	1,522	1,115	650	447	453	120	272	223	283

Maturity and fertility data were taken on the seedling varieties grown in the 10-hill rows. About 66 percent of the 1,862 selections were rated very early to medium in maturity. The other 34 percent were late or very late. Nearly 58 percent of all the seedlings in these plots produced seed by open pollination. In 1949 only 25 percent of the seedlings in the 10-hill plots showed any signs of self-fertility. The difference was due mostly to seasonal variation.

P.I. table 6 presents a summary of the maturity and fertility data on the seedling varieties grown in 10-hill rows on the Chapman farm in 1950.

P.I. table 6. Maturity and fertility data for seedling varieties grown in 10-hill or multiple 10-hill rows at Chapman Farm, Presque Isle, Maine, 1950.

Maturity classes	Seedlings		Fertility classes	Seedlings	
	No.	Pct.		No.	Pct.
Very early	224	12.0	None	787	42.2
Early	400	21.5	Slight	105	5.6
Medium	619	33.2	Medium	166	8.9
Late	588	31.6	Good	808	43.3
Very late	31	1.7			
Total	1,862	100.0		1,866	100.0

At Aroostook Farm formal tests are being conducted to study resistance to seven major diseases of potatoes: Late blight, scab, ring rot, virus A, virus X, virus Y, and leaf roll.

The best selections from these tests are increased, sent to cooperators, and used as parents. A few of the more promising ones are tested in replicated plots for yield, specific gravity of the tubers, and other horticultural characters. In 1950, 35 of these, varying in maturity from early to late, were tested in comparison with Irish Cobbler. The data for this test are given in P.I. table 7.

A number of the seedling varieties outyielded the Irish Cobbler significantly, and some of these showed resistance to two or more diseases.

B 294-29, an early variety, outyielded Irish Cobbler, but its tubers did not show as high specific gravity as that of the check variety. However, it is resistant to aphid injury. So far, no such variety has been distributed.

We have released a number of varieties immune in the field from virus A but none from virus X. The latter virus causes large reductions in yield in some varieties so that one of our principal objectives is to breed varieties that are immune. Four of those listed in P.I. table 7 have shown an immune reaction to virus X. B 926-9 is resistant not only to virus X but to scab and virus A. It is medium in maturity. It yielded at the rate of 771 bushels per acre, but from the statistical standpoint it was not so high in specific gravity as Irish Cobbler. However, it is doubtful that the difference between 1.080 and 1.074 could be detected in a cooking test. Further tests of the best of these will be made before any of them are offered for release. Some of these may be of interest to cooperators as parent material.

The data for yield, percentage of U. S. No. 1 potatoes, and specific gravity of three numbered varieties and eight recently named varieties tested in comparison with Irish Cobbler are given in P.I. table 8.

Of these, Ashworth, Chenango, and Chisago outyielded the check; the others were in the same class in yield as Irish Cobbler. None of the varieties, including the check, was high in specific gravity. If 1.080 is taken as the lower limit for a baker, none of them would classify as bakers.

A number of blight-resistant varieties were tested for yield and specific gravity in comparison with standard varieties (P.I. table 9). Green Mountain ranked first in yield but not significantly higher than the Canadian blight-resistant variety F 346, Kennebec, or Essex. Green Mountain and F 346 were in the same specific gravity class, but they were both higher in this respect than Kennebec or Essex. The tubers of Essex were lower in specific gravity than any of the others in the test.

Another group of disease-resistant varieties were tested for yield and specific gravity in comparison with Katahdin and Kennebec. The data for this test are given in P.I. table 10. Three varieties in this table are worthy of special consideration: B 446-8 is resistant to late blight and ring rot. It ranked first in yield but is not so high in specific gravity as is desirable. B 606-67 is resistant to late blight and virus X. It produced a high yield and ranked first in specific gravity. No variety showing an immune reaction to virus X has so far been released, but several, including B 606-67, are promising from the commercial standpoint. B 936-12 shows resistance to leaf roll and virus X. It yields as well as Katahdin but not as high as Kennebec and some of the others. If it continues to show resistance to leaf roll it might be valuable to growers in sections where this virus takes a heavy toll.

P.I. table 7. Yield and percentage of U. S. No. 1 tubers and specific gravity readings of early, medium, and late numbered varieties in comparison with Irish Cobbler on Aroostook Farm, Maine.

Variety	Maturity	Yield per acre U. S. #1		Specific gravity	Resistant to:
		Bu.	Pct.		
Irish Cobbler	E	565	94	1.080	Mild mosaic.
B 294-29	E	707	98	1.070	Aphid injury.
B 381-2	M	552	87	1.079	Scab.
B 402-1	M	514	96	1.068	Scab.
B 579-11	M	604	94	1.075	Leaf roll.
B 605-10	E	726	97	1.077	Late blight.
B 721-1	E	602	94	1.071	Ring rot.
B 721-35	E	603	97	1.074	Ring rot.
B 725-8	L	665	97	1.075	Ring rot.
B 773-8	E	623	97	1.078	Late blight and scab.
B 780-27	M	696	98	1.074	Virus X and ring rot.
B 904-6	M	640	98	1.072	Late blight and scab.
B 911-10	M	657	96	1.071	Ring rot
B 911-31	L	648	96	1.073	Ring rot
B 919-15	M	482	96	1.070	Ring rot, late blight, and virus X.
B 920-7	E	461	90	1.075	Late blight and scab.
B 920-12	M	449	97	1.069	Scab.
B 922-3	E	677	97	1.068	All races of late blight in Beltsville collection.
B 922-5	M	494	88	1.069	Do
B 922-6	E	459	93	1.079	Do
B 926-9	M	771	98	1.074	Scab, virus A, and virus X.
B 953-8	M	537	92	1.088	Viruses A and X.
B 961-20	M	614	94	1.072	Scab.
B 962-1	E	487	91	1.078	Scab and late blight.
B 962-3	E	661	95	1.076	Do
B 962-9	M	558	94	1.078	Do
B 962-16	L	644	99	1.083	Do
B 991-3	E	525	98	1.074	Do
B 991-6	E	367	96	1.070	Do
B 991-13	M	545	98	1.075	Ring rot, scab, and late blight.
B 991-14	M	511	97	1.079	Do
B 2067-18	L	699	94	1.075	Scab.
B 2067-21	L	663	96	1.065	Scab.
B 2067-97	M	539	93	1.073	Scab.
B 2160-21	M	613	93	1.070	Scab.
B 738-16	M	462	96	1.076	Late blight.
L.S.D.		86		.003	

P.I. table 8. Yield and specific gravity data of three numbered varieties and eight recently named varieties in comparison with Irish Cobbler on the Aroostook Farm, Presque, Isle, Maine, in 1950.

Variety	Yield per acre, U. S. No. 1		Specific gravity
	Bu.	Pct.	
Irish Cobbler	552	94	1.079
X 96-56	614	98	1.071
B 294-22	584	92	1.075
N. D. 530	538	96	1.077
Ashworth	632	97	1.073
Chenango	627	91	1.075
Warba	555	94	1.075
Chisago	622	97	1.073
Satapa	590	95	1.074
Waseca	525	94	1.071
Progress	501	79	1.073
Yampa	592	94	1.078
L.S.D.	63		.003

P.I. table 9. Yield and percentage of U. S. No. 1 tubers and specific gravity readings of late varieties in comparison with Katahdin and Kennebec on the Aroostook Farm, Maine, in 1950.

Varieties	Yield per acre of U.S. No. 1		Specific gravity
	Bu.	Pct.	
Katahdin	674	96	1.073
Kennebec	750	98	1.076
Green Mountain	811	97	1.085
Sequoia	684	98	1.074
Empire	566	98	1.080
Essex	719	94	1.068
Placid	692	97	1.075
Snowdrift	628	92	1.070
Virgil	602	96	1.079
N.D. 184-84	588	90	1.071
F 346 1/	761	97	1.083
F 391 1/	604	94	1.082
F 431 1/	582	98	1.078
F 4419 1/	537	96	1.076
L.S.D.	108		.003

1/ The four seedlings marked F are blight-resistant selections from the Canadian Agricultural Experiment Station, Fredericton, N.B., Canada.

P.I. table 10. Yield and specific gravity data for seven late numbered varieties compared with Katahdin and Kennebec.

Variety	Yield per acre U. S. No. 1		Specific gravity	Resistant to:
	Bu.	Pct.		
Katahdin	653	96	1.078	Virus A and net necrosis.
Kennebec	797	99	1.079	Late blight.
B 446-8	807	98	1.073	Late blight and ring rot.
B 606-67	766	97	1.083	Late blight and virus X.
B 905-1	593	98	1.072	Late blight.
B 911-26	647	96	1.065	Ring rot.
B 936-12	687	98	1.076	Leaf roll and virus X.
B 2067-1	596	93	1.082	Scab.
B 2140-21	765	98	1.079	Scab and late blight.
L.S.D.	73		.003	

Early Harvesting

Early harvesting is recommended for foundation seed growers and others who wish to produce stock with a minimum of virus infection. Some seasons this practice greatly reduces the resulting yields. In 1950 eight varieties of potatoes were planted May 5. Tops were pulled August 16, August 26, and September 5, and the vines were killed by frost on September 14. The data for this test are given in P.I. table 11.

The plots on which the vines were pulled August 16 yielded at the rate of 291 bushels of U. S. No. 1 potatoes for a mean of the eight varieties; for August 26, the mean was 397 bushels; September 5, 485 bushels; and on the plots on which the vines were killed September 14 the mean yield was 553 bushels. These results show an increase in yield of 90 percent in the 29 days from August 16 to September 14.

Comparing the varieties, it is evident again that early tuber setting is of greater importance than early vine dying. The Kennebec, a late-maturing but early tuber-setting variety, yielded at the rate of 366 bushels per acre, as compared with 263 bushels for Irish Cobbler 103 days after planting and maintained this advantage throughout. The Kennebec increased about 100 bushels every 10 days from August 16 to September 14.

The highest mean specific gravity of the tubers was found in the plots where the vines were pulled on August 16. This is somewhat surprising since it has been generally considered that the more immature the tubers the lower the specific gravity. These plots were all dug on September 16, and it may be that those left in the ground without vines for 31 days lost moisture. Again, the growing conditions for this period may have been more conducive to high yields than to high specific gravity.

There was a significant difference between varieties with respect to yield, number of U. S. No. 1 tubers per hill, and specific gravity.

P.I. table 11. Yield and percentage of U. S. No. 1 tubers, number of tubers, and specific gravity of tubers of eight varieties of potatoes planted on the same date, but the tops were pulled at four different dates.

Dates tops pulled and variety	Yield per acre U. S. No. 1		Mean per hill of U.S. No. 1 tubers		Specific gravity
	Bu.	Pct.	No.	Pct.	
August 16, 1950					
Mohawk	308	93	3.8	82	1.081
Sebago	264	82	3.6	65	1.073
Katahdin	272	88	3.9	75	1.080
Chippewa	278	85	3.7	67	1.074
Green Mountain	289	83	4.6	70	1.087
Teton	284	89	3.7	78	1.085
Irish Cobbler	263	81	4.0	66	1.089
Kennebec	366	94	3.7	79	1.080
Mean	291		3.9		1.081
August 26, 1950					
Mohawk	386	95	3.6	81	1.083
Sebago	344	88	4.5	70	1.072
Katahdin	359	93	3.9	80	1.078
Chippewa	394	93	4.3	79	1.070
Green Mountain	477	94	5.3	83	1.083
Teton	368	93	4.2	81	1.083
Irish Cobbler	383	87	5.1	73	1.085
Kennebec	466	95	3.8	81	1.081
Mean	397		4.3		1.079
September 5, 1950					
Mohawk	498	97	3.9	85	1.085
Sebago	489	94	5.0	82	1.075
Katahdin	444	93	4.5	84	1.076
Chippewa	474	93	5.0	79	1.070
Green Mountain	577	96	5.7	89	1.087
Teton	442	96	4.0	88	1.080
Irish Cobbler	379	89	5.2	77	1.086
Kennebec	573	97	3.8	86	1.080
Mean	485		4.6		1.080
September 14, 1950					
Mohawk	573	97	3.8	82	1.086
Sebago	548	94	5.1	73	1.078
Katahdin	507	95	4.6	80	1.079
Chippewa	540	95	5.2	77	1.067
Green Mountain	608	96	5.5	84	1.085
Teton	525	97	4.6	86	1.078
Irish Cobbler	448	90	5.5	77	1.083
Kennebec	675	98	4.1	88	1.080
Mean	553		4.8		1.079
L.S.D. between variety means----------	67		1.06		.003
L.S.D. between date means	24		0.37		.001

Date of Planting

R. V. Akeley, D. J. Merriam, F. J. Stevenson, and R. Bonde

The date-of-planting test was repeated in 1950, using the same eight varieties as were used in 1949. The plantings were made on May 5, May 15, May 26, and June 5. The vines were killed by frost on September 14. The data for this test are given in P.I. table 12.

The average yield for the eight varieties for the second date of planting, May 15, was the highest. The first date of planting ranked second, with the third and fourth dates ranking third and fourth in yield, respectively. In this respect, the results were the same as those for 1949. The mean specific gravities for the eight varieties ranked in the same order as the planting dates, but the differences were not so great as those for last year. Kennebec produced at the rate of 599 bushels of U. S. No. 1 potatoes for an average of the four dates of planting. Green Mountain was a close second, with a mean of 594. There were no significant differences between the mean number of U. S. No. 1 tubers per hill as a result of different dates of planting.

Scab Resistance

The scab test was in the same field as usual in 2-hill rows adjacent to Green Mountain check rows. Forty-nine family lines, representing 784 seedlings and 26 parents were compared.

Of the 784 seedlings tested, 36 showed only a trace of surface covered with scab at harvesttime, and 384 had a mean coverage of 10 percent. These two classes represent 420 seedlings or 53.6 percent of the total number. The adjacent 784 Green Mountain checks average well over 30 percent coverage, and all were of pustule type 3 or higher, except one that was type 2. Assuming pustule types 1 and 2 as resistant, then 415 seedlings (52.9 percent) are more resistant than the checks. This year seedling B 515-2 was the only parent to show only a trace of pustule type 1. Fifteen other parents showed a mean of 10 percent coverage, and most of them has pustule types 1 and 2.

P. I. table 13 gives a summary of the data obtained for the scab tests in 1950.

Late Blight Resistance

During May 1950, 47 family lines or 935 seedlings were planted in single hills in the bench of the greenhouse on the Aroostook Farm. The bench was enclosed with a cage, and an automatic humidifier was used to keep moisture conditions ideal. These seedlings were inoculated several times with the common race of late blight as soon as they were 4 inches or more above ground. In August 5 tubers of each seedling in the former blight test were harvested from duplicate plots on the Chapman Farm, and within 2 days were placed in the same greenhouse cage and inoculated with common late blight for a tuber rot test.

Approximately 44.8 percent or 419 seedlings remained free (rated zero) for blight in the foliage test; the other 516, or 55.2 percent, were susceptible. In the tuber test, 889 seedlings were exposed. About 431 or 48.5 percent of these remained free from late blight tuber rot, and 173 or 19.5 percent showed only a trace. P.I. table 14 gives a summary of this data.

P. I. table 12. Yield and percentage of U. S. No. 1 tubers, number of tubers, and specific gravity of tubers of eight varieties of potatoes planted on four different dates on the Aroostook Farm, Presque Isle, Maine, in 1950.

Planting date and variety	U.S. No. 1 tubers - Yield per acre		U. S. No. 1 tubers - Mean per hill		Specific gravity
	Bu.	Pct.	No.	Pct.	
May 5, 1950					
Mohawk	517	96	3.5	85	1.087
Sebago	573	95	4.8	86	1.079
Katahdin	440	94	3.9	81	1.080
Chippewa	487	94	4.9	81	1.069
Green Mountain	615	96	5.1	88	1.089
Teton	476	96	3.9	92	1.080
Irish Cobbler	421	93	4.2	85	1.083
Kennebec	654	97	3.6	91	1.082
Mean	523 1/		4.24 2/		1.081 3/
May 15, 1950					
Mohawk	598	97	3.6	85	1.087
Sebago	572	96	4.4	85	1.075
Katahdin	479	96	3.8	83	1.078
Chippewa	594	95	4.1	82	1.067
Green Mountain	593	96	5.2	85	1.085
Teton	556	97	4.2	89	1.073
Irish Cobbler	445	94	4.8	81	1.081
Kennebec	646	98	3.5	87	1.076
Mean	560 1/		4.20 2/		1.078 3/
May 26, 1950					
Mohawk	496	98	3.7	84	1.085
Sebago	496	97	4.6	78	1.074
Katahdin	455	96	3.5	81	1.076
Chippewa	423	94	4.7	78	1.067
Green Mountain	607	97	4.9	88	1.089
Teton	512	97	4.3	89	1.074
Irish Cobbler	358	91	4.2	78	1.077
Kennebec	575	98	3.8	91	1.077
Mean	490 1/		4.21		1.077 3/
June 5, 1950					
Mohawk	408	98	3.3	85	1.081
Sebago	422	96	4.5	82	1.071
Katahdin	408	97	3.8	82	1.074
Chippewa	500	97	4.2	80	1.067
Green Mountain	560	97	4.8	84	1.081
Teton	517	99	4.6	89	1.076
Irish Cobbler	470	97	5.0	84	1.082
Kennebec	521	99	3.8	86	1.074
Mean	476 1/		4.25 2/		1.076 3/
L.S.D.	91		1.98		.003

1/ The L.S.D. between mean yields per acre of the 8 varieties for any 2 dates of planting is 32 bushels.

2/ The L.S.D. between mean number of tubers per plant for any 2 dates of planting is 0.70.

3/ The L.S.D. between mean specific gravities for any 2 dates is 0.001.

P.I. table 13. Summary of the data obtained on the scab tests on the Aroostook Farm, Maine, in 1950.

Material tested	No.	Surface area covered 1/					Type of pustule 2/					
		T	1	2	3	4	1	2	3	4	5	X
Seedling varieties	784	36	384	255	104	5	195	220	320	39	7	3
Green Mt. checks	784	0	5	57	605	117	0	1	549	145	89	

1/ Surface area covered

T = Less than 1 percent.
1 = 1 to 20 percent.
2 = 21 to 40 percent.
3 = 41 to 60 percent.
4 = 61 to 80 percent.

2/ Type of pustule

1 = Small superficial.
2 = Larger but still superficial.
3 = Large, rough pustules.
4 = Large pustule, shallow holes.
5 = " " deep "

P.I. table 14. Summary of the data obtained on the tests for resistance to late blight in the greenhouse at Presque Isle, Maine, in 1950.

Varieties	No.	Foliage test 1/		No.	Tuber classes 2/					
		S	0		0	1	2	3	4	5
Seedlings	935	516	419	889	431	173	112	86	57	30

1/ The blight data for 1950 were taken in two classes: S = infected; 0 = not infected.

2/ Tuber classes

0 = No rot on any of the tubers.
1 = One out of five tubers with late blight rot.
2 = Two " " " " " " "
3 = Three out of five tubers with late blight rot.
4 = Four " " " " " " "
5 = Five " " " " " " "

Quality of French Fries as Influenced by Variety, Date of Planting, and Date of Harvesting

R. V. Akeley

Date of Planting

At present there is much interest in potatoes from which high-quality french fries can be made. It has been found that varieties differ when grown under the same conditions but that cultural practices and environment under which the potatoes are grown are about as important as variety in determining cooking quality, regardless of the cooking method.

In 1950 a date-of-planting test consisting of 8 varieties grown in 4 replications at 4 different dates was grown to determine the effect of date of planting on yield, specific gravity, and other characters. Samples from each of the replications were stored in the fall at 40° F. until December 5. On that date they were moved into another store room and kept at 60° for 42 days. At the end of that time french fries were made. Two square one-half-inch plugs were taken from 5 tubers of each replication. The 10 plugs were cooked in pure vegetable oil for 4 minutes at a temperature range of 375° to 380° F. After frying the strips were cooled and judged for color and texture. The data for these tests are given in Akeley table 1.

The french fries were placed in seven classes according to the degree of browning. Class 1 showed a very deep brown color not acceptable to the trade. Class 7 was a very light tan, almost white.

Green Mountain was the poorest variety for all dates of planting. Kennebec was the best, giving desirable french fries for all four dates of planting. This was true also of Irish Cobbler and most of the others except Green Mountain. In the analysis of variance the dates of planting showed highly significant differences but not so great as the varieties.

Date of Harvesting

In 1950 a date-of-harvesting test was made consisting of eight varieties grown in four replications. The tops were removed from one lot on August 16, from another on August 26, from the third lot on September 5, and frost killed the tops of the fourth lot on September 14. Samples were saved, stored, and french fried according to the methods described for the date-of-planting test. The data for the date-of-harvesting test are given in Akeley table 2.

As in the date-of-planting test, the poorest french fries were made from the Green Mountain and the best from the Kennebec. The earliest harvest gave on the average the highest quality french fries. The tubers of this group probably had a lower sugar content than those harvested later.

Akeley table 1. French-fry quality ratings of eight varieties of potatoes planted on four different dates on the Aroostook Farm, Presque Isle, Maine, in 1950.

Variety	Class means for planting dates 1/				Class average 2/
	5-5	5-15	5-26	6-5	
Irish Cobbler	4.32 3/	4.47	4.22	3.92	4.23
Katahdin	3.92	3.87	3.85	3.47	3.78
Green Mountain	2.00	1.87	1.60	1.70	1.79
Teton	3.52	3.57	3.50	2.57	3.29
Mohawk	3.37	2.97	3.52	2.30	3.04
Sebago	4.12	4.37	4.15	3.92	4.14
Chippewa	4.35	3.97	4.15	3.77	4.06
Kennebec	5.35	4.45	5.05	4.32	4.79
Class average 4/	3.87	3.69	3.75	3.25	

1/ Quality ratings based on degree of browning:

Classes	Degree of browing
1	Very deep brown.
2	Deep brown.
3	Medium deep brown.
4	Medium brown.
5	Medium light brown.
6	Light brown.
7	Very light brown (almost white).

2/ L.S.D. between means of four dates for any two varieties, 0.31

3/ L. S. D. between means of any two varieties or dates is, 0.62.

4/ L. S. D. between means of eight varieties for any two dates is 0.22.

Akeley table 2. French-fry quality ratings of eight varieties of potatoes harvested on four different dates on the Aroostook Farm, Presque Isle, Maine, in 1950.

Variety	Class means for harvest dates [1]				Class means [2]
	8-16	8-26	9-5	9-14	
Irish Cobbler	4.65 [3]	4.22	4.60	3.52	4.25
Katahdin	4.20	3.62	2.97	3.65	3.61
Green Mountain	1.63	1.75	1.25	1.97	1.65
Teton	3.78	3.75	3.55	3.42	3.62
Mohawk	2.80	2.35	2.25	2.77	2.54
Sebago	4.65	4.15	2.97	4.10	3.97
Chippewa	4.28	4.25	3.47	4.55	4.14
Kennebec	4.65	4.47	4.37	4.55	4.51
Class means [4]	3.83	3.57	3.18	3.57	

1/ See table 1 for quality ratings.
2/ L. S. D. between means of four dates for any two varieties is 0.33
3/ L. S. D. " " of any two varieties or dates is 0.66.
4/ L. S. D. " " of eight varieties for any two dates is 0.23.

P.I. table 13. Summary of the data obtained on the scab tests on the Aroostook Farm, Maine, in 1950.

Material tested	No.	Surface area covered 1/					Type of pustule 2/					
		T	1	2	3	4	1	2	3	4	5	X
Seedling varieties	784	36	384	255	104	5	195	220	320	39	7	3
Green Mt. checks	784	0	5	57	605	117	0	1	549	145	89	

1/ Surface area covered

T = Less than 1 percent.
1 = 1 to 20 percent.
2 = 21 to 40 percent.
3 = 41 to 60 percent.
4 = 61 to 80 percent.

2/ Type of pustule

1 = Small superficial.
2 = Larger but still superficial.
3 = Large, rough pustules.
4 = Large pustule, shallow holes.
5 = " " deep "

P.I. table 14. Summary of the data obtained on the tests for resistance to late blight in the greenhouse at Presque Isle, Maine, in 1950.

Varieties	No.	Foliage test 1/		No.	Tuber classes 2/					
		S	0		0	1	2	3	4	5
Seedlings	935	516	419	889	431	173	112	86	57	30

1/ The blight data for 1950 were taken in two classes: S = infected; 0 = not infected.

2/ Tuber classes

0 = No rot on any of the tubers.
1 = One out of five tubers with late blight rot.
2 = Two " " " " " " "
3 = Three out of five tubers with late blight rot.
4 = Four " " " " " " "
5 = Five " " " " " " "

Quality of French Fries as Influenced by Variety, Date of Planting, and Date of Harvesting

R. V. Akeley

Date of Planting

At present there is much interest in potatoes from which high-quality french fries can be made. It has been found that varieties differ when grown under the same conditions but that cultural practices and environment under which the potatoes are grown are about as important as variety in determining cooking quality, regardless of the cooking method.

In 1950 a date-of-planting test consisting of 8 varieties grown in 4 replications at 4 different dates was grown to determine the effect of date of planting on yield, specific gravity, and other characters. Samples from each of the replications were stored in the fall at 40° F. until December 5. On that date they were moved into another store room and kept at 60° for 42 days. At the end of that time french fries were made. Two square one-half-inch plugs were taken from 5 tubers of each replication. The 10 plugs were cooked in pure vegetable oil for 4 minutes at a temperature range of 375° to 380° F. After frying the strips were cooled and judged for color and texture. The data for these tests are given in Akeley table 1.

The french fries were placed in seven classes according to the degree of browning. Class 1 showed a very deep brown color not acceptable to the trade. Class 7 was a very light tan, almost white.

Green Mountain was the poorest variety for all dates of planting. Kennebec was the best, giving desirable french fries for all four dates of planting. This was true also of Irish Cobbler and most of the others except Green Mountain. In the analysis of variance the dates of planting showed highly significant differences but not so great as the varieties.

Date of Harvesting

In 1950 a date-of-harvesting test was made consisting of eight varieties grown in four replications. The tops were removed from one lot on August 16, from another on August 26, from the third lot on September 5, and frost killed the tops of the fourth lot on September 14. Samples were saved, stored, and french fried according to the methods described for the date-of-planting test. The data for the date-of-harvesting test are given in Akeley table 2.

As in the date-of-planting test, the poorest french fries were made from the Green Mountain and the best from the Kennebec. The earliest harvest gave on the average the highest quality french fries. The tubers of this group probably had a lower sugar content than those harvested later.

Effect of Sprays on Yield of Certain Potato Varieties

P. M. Lombard and R. V. Akeley

Although Kennebec is highly resistant to if not immune from the common races of late blight that are prevalent in Maine, the growers continue to spray it with fungicides as often as they spray susceptible varieties, such as Green Mountain. For 2 years tests have been made to study the effects of various sprays on a number of potato varieties. It is evident from these tests that bordeaux mixture is of no value when used on Kennebec.

The results of the 1949 tests were given in last year's report. The results for 1950 follow.

The 1950 test was similar to the one conducted in 1949 with three exceptions: Sebago was used in place of Menominee, the number of plants per plot was increased from 25 to 30, and the plants were spaced 10 inches apart instead of 12. As before, four treatments were used: Bordeaux, bordeaux + DDT, DDT, and no spray. The design of the experiment was a split block 4 x 4 latin square. The four varieties were planted in each block with four border rows of Teton on each side to protect the varieties under test from spray drift. Each plot consisted of 30 hills, planted 10 inches apart, and the rows were 34 inches apart. The plots were inoculated with late blight on July 13, and a heavy epidemic was soon prevalent on the border rows of Teton, which were not sprayed, and on the non-sprayed plots of the susceptible varieties in the test.

The yield data for this test are given in P.I. table 15.

P. I. table 15. The effect of sprays on the yields of four varieties of potatoes grown on Aroostook Farm, Presque Isle, Maine, in 1950.

Sprays	Yield per acre of U. S. No. 1 healthy tubers									
	Kennebec		Green Mountain		Sebago		Katahdin		Mean	
	Bu.	Pct.	Bu.	Pct.	Bu.	Pct.	Bu.	Pct.	Bu.	Pct.
Bordeaux	569	98	522	94	455	92	459	93	509	94
Bordeaux + DDT	658	98	571	93	471	93	520	94	555	95
DDT	665	97	359	78	403	91	339	86	441	88
Check (no spray)	540	97	332	79	384	89	355	86	403	88
Mean	608	98	446	86	428	91	418	90	477	91

L.S.D. for treatment = 22.8 bushels.
" " varieties = 34.8 "
" " two varieties with same treatment = 69.5 bushels.
" " two treatments in same or different = 65.9 "

It will be noted that there was no significant difference between the yields produced by the Kennebec plots that received no spray and those that were sprayed with bordeaux. The highest yields produced by this variety were from the plots sprayed with DDT alone, although there was no significant difference between the yields of the plots sprayed with bordeaux + DDT and those sprayed with DDT only. From the data, it is evident that it would pay to spray

Virus A, continued

Pedigree No.	Parentage	Varieties	Reaction of varieties to other diseases		
			Virus A	TN = Top necrosis LR = Leaf roll RM = Rugose mosaic	
		No.	Pct.		Pct.
B 926	B 66-1 x (X 792-94)			LR	30
				RM	50
		10	10	TN	40
B 946	Ostbote x Katahdin	18	66	TN	72
				LR	44
				TN	100
B 950	Starkeragis x Katahdin	8	57	LR	25
B 953	Mohawk x (X 792-94)	14	21	LR	50
B 956	Gr. Mountain x Katahdin	10	100	LR	30
B 983	(X 792-86) x (X792-94	9	33	LR	77
B 984	Gr. Mountain x (X792-94)	10	50	LR	30
B 985	Mohawk x (X792-94)	11	54	LR	73
B 1162	X792-94 selfed	12	33	LR	58
	Green Mountain control	30 hills	100		
B 210 [3/]	Ostbote x Earlaine	35	20	TN	16
B 2135	B 70-5 x B 61-3	31	35	(LR (TN	(58 (51
B 2190	41958 x (X 792-94)	14	43	TN	7
				RM	7
				LR	28
B 1172	Chippewa selfed	39	51	TN	80
				LR	30
B 1173	Earlaine selfed	27	14	RM	22
				LR	7
B 1178	Starkeragis selfed	20	90	TN	80
				LR	65
B 1180	Katahdin selfed	15	6	TN	60
				LR	29
	Controls				
	Katahdin	5 hills		TN	100
	Chippewa	5 "		TN	100
	Earlaine	5 "			
	41956	5 "			
	X 792-94	5 "			
	Ostbote	5 "	100	TN	100
	Starkeragis	5 "	100	TN	100
	B 61-3	5 "	100	TN	100
	Kennebec	5 "			
	Gr. Mountain	45 "	100		

1/ Dosed every hill 7/17 and 18/49 when in blossom with 50-100 Myzus persicae aphids that were cultured on mild mosaic Gr. Mt. under cloth cages.

2/ B 881 - B 1162 exposed in 1948 and 1949.

3/ B 2104 - B 1180 and controls exposed in 1949.

Virus Y

E. S. Schultz

Resistance of seedling potato varieties to virus Y varieties. Five hills per variety of potato were exposed in alternate hills to virus Y 42898 and to infestations of Y viruliferious Myzus persicae at Aroostook Farm, Presque Isle, Maine, in 1950.

Four hundred and seventy-two seedling potato varieties, representing four crosses and Chippewa selfed were planted so that five hills of a seedling variety alternated with an equal number of hills of the virus Y 42898 potato seedling variety. Green Mountain served as the virus-Y-susceptible control. Resistance to common scab, late blight, leaf roll, and viruses A and Y is harbored by some parents. Exposure of those varieties began in 1950 on Aroostook Farm, Presque Isle, Maine.

On July 19 to 22 when the potatoes were in bloom Myzus persicae infested leaves of virus Y 42898 seedling potato variety were deposited on the seedling varieties to supplement field infestation. Natural field infestations with aphids were sparse due to heavy infestations with lady beetles. However, an adequate number of the Y viruliferious M. persicae that were deposited on the seedling varieties succeeded in feeding on the plants before they were anihilated by the lady beetles, as the infection discloses.

Observations on August 18 to 22 disclosed that every hill of the Green Mountain controls and 79 to 99 percent of the seedling potato varieties had contracted virus Y. Foliage and stem necrosis characterized most of the varieties infected with virus Y. The few seedling varieties that did not contract virus Y in the 1950 test and that have not become infected in the 1943-1950 tests apparently are more highly resistant to virus Y infection than field-resistant varieties like Chippewa and Katahdin.

The data for these tests are given in the table that follows.

Reaction of seedling potato varieties to virus Y in field-exposure to virus Y 42898 seedling potato variety[1], Aroostook Farm, Presque Isle, Maine, 1950

Parentage	Pedigree number	Varieties	Year exposed	Virus Y varieties	Virus Y hills in infected varieties
		No.		Pct.	Pct.
Chippewa x Katahdin	B 2427	27	1950	92	20-100
" x B 61-3	B 2428	140	1950	99	100
" x (157-9)	B 2429	237	1950	91	40-100
" x B 445-41	B 2431	54	1950	92	100
" selfed	B 1210	14	1950	79	20-100
Controls					
Katahdin		1	1950	100	100
Chippewa		1	1950	100	100
X 157-9		1	1950	100	100
B 61-3		1	1950	100	100
Green Mountain		9[2]	1950	100	100
B 515 N. Dak.		1	1950	100	100
B 738-8 N. Dak.		1	1950	100	100
Snowdrift		1	1950	100	100
F 346		1	1950	100	100
F 396		1	1950	100	100
F 431		1	1950		
F 451		1	1950		
F 458		1	1950	100	80
F 4328		1	1950	100	100
F 4417		1	1950	100	60
F 4419		1	1950	100	100
Chippewa x B 76-23	B 2065	33	1949-1950	97	100
" x B 381-2	B 2067	157	1949-1950	96	100
" x 522-33	B 2068	30	1949-1950	93	100
" x (X528-170)	B 2069	100	1949-1950	98	100
" x B 594-46	B 2070	127	1949-1950	99	100
" selfed	B 1172	44	1949-1950	93	100
Katahdin x 792-94	205	99	1943-1950	99	100
1241-66 x 792-94	208	12	1943-1950	90	100
1241-62 x 792-76	524	135	1945-1950	97	100
Gr. Mountain control		2[2]	1950	100	100

[1] Virus Y leaves of virus Y seedling potato variety 42898 infested with Myzus persicae under cloth cages were deposited onto the seedling potato varieties in the field July 19-22 when the plants were in blossom.

[2] Number of 5-hill controls.

SOUTHEASTERN PROJECT
(Louisiana Headquarters)

Theodore P. Dykstra, United States Department of Agriculture, and Julian C. Miller, Raymon E. Webb, and John Noonan, Louisiana Agricultural Experiment Station

---

The potato-breeding program of the Southeastern States is conducted cooperatively by the United States Department of Agriculture and the Louisiana Agricultural Experiment Station. In addition to this, the Louisiana Station conducts investigations on testing the performance of promising seedlings and varieties in different sections of the State, and on determining the effect of different storage temperatures and length of storage on performance of seed potatoes grown in the Northern States, as well as those grown in Louisiana in the spring and fall.

The United States Department of Agriculture is primarily interested in phases of the work of regional importance. It distributes promising seedlings to the Southeastern cooperative States and compares their performance in these States.

This is a joint report of the investigations of the Louisiana Agricultural Experiment Station and the United States Department of Agriculture.

The potato-breeding program of the southeastern States is making progress. It was considered, therefore, advisable to invite all the cooperators of this regional project to Crossville, Tenn., in August 1950, when the seedlings and increase plots were to be dug, to take stock of the advance that has been made and to consider any other methods of approach that might be proposed.

The cooperators were given the opportunity to see the plots, to become more familiar with the objectives of the work, and to select those seedlings that in their viewpoint were most apt to meet the need of the potato industry in their respective States. A better understanding of the needs of the different States and the objectives of the program was obtained as a result of this conference.

In addition to Dr. F. J. Stevenson, leader of the national potato-breeding program, and Dr. Hougas, in charge of the North-Central Potato Introduction Station in Wisconsin, representatives from the Homestead and Hastings districts of Florida and from Georgia, Mississippi, Virginia, Alabama, Tennessee, North Carolina, South Carolina, Louisiana, and Texas were present.

The growing season this year has been exceptionally favorable in Tennessee, and a very satisfactory yield of seedlings was obtained. During the last few years we have developed several additional red-skinned seedlings, one of our major objectives, namely, the development of a blight- and scab-resistant red variety well adapted to growing conditions in the deep South. We are making substantial progress in obtaining this goal, and some of the more promising ones are grown for increase in South Dakota.

We also continue to maintain our interest in the white varieties, since there is a definite place in the South for a desirable blight-resistant white variety. More progress has been made to date in developing disease resistance in these varieties than in the red ones.

Our crosses in Baton Rouge are made early in the spring, and at Crossville, Tenn., during the early summer. On account of frequent unfavorable climatic conditions, the South is not the ideal place to make crosses. Very few crosses were successful in Baton Rouge in the spring of 1950, although in some years satisfactory results are obtained. Because of cool weather during June we were quite successful in making several crosses in Crossville, Tenn.

Since one of the objectives of the national potato-breeding program is to provide mutual aid, we try to take full advantage of this provision by requesting material from co-workers, as well as extending an invitation to share our material with others. In addition to using seed from our own crosses, we also obtain seed from crosses that carry factors desirable for potatoes to be grown in the South, from Dr. F. J. Stevenson of Beltsville, Md. This fall we also received some seed from different crosses that carried factors for red color and scab resistance from Mr. W. C. Edmundson, Greeley, Colo. Single tubers from desirable first-year seedlings were also obtained from Dr. F. J. Stevenson and from Dr. C. E. Peterson of Iowa.

An interesting observation was made during the summer in one plot in Crossville. In view of the fact that some of the factors contributing to seed setting in potatoes are still obscure, these observations are recorded for what they are worth.

In the spring of 1950, two rows of Kennebec were planted with seed potatoes obtained from Maine. An additional two rows were planted with seed that came originally from Maine, but had been grown in Tennessee last year. Because of insufficient fertilizer at planting time, these last two rows were not fertilized. When these plants were about 8 inches tall they lacked vigor and showed definite signs of lack of nutrition. A side dressing of fertilizer, equivalent to the original amount given to the other potatoes in the plot, was applied. The Kennebec from both seed sources bloomed profusely, but the Tennessee-grown seed, because of a temporary stunting due to lack of fertilizer, flowered about 10 days later. Although many crosses were made on Kennebec from Maine-grown seed, none of these was successful, and not a single seed ball formed on these 800 plants as a result of open pollination. Crosses made on other varieties at the same time were successful, and open-pollinated seed balls also developed at this time in several seedlings.

The Tennessee-grown seed of Kennebec flowered 10 days later, and this time a large number of seed balls developed as a result of open pollination. The open-pollinated seed balls undoubtedly came as a result of selfing rather than from cross pollination due to natural causes. The difference in the pronounced amount of seed setting between these two lots is difficult to explain on the basis of temperature.

The only other noticeable difference was the temporary stunting in the one lot and its subsequent normal growth with additional fertilizer.

We are continuing to test in moist chambers in the greenhouse first-year seedlings from parents carrying factors for blight resistance and eliminating all the seedlings in these progenies that are susceptible, as described in detail in last year's report. The progenies from parents carrying factors for scab resistance are tested in scab-infested soil in the cold frame. In additiona, water suspensions of Mycelium and spores of Actinomyces scabies are poured around the seedlings three or four times during the growing season. At digging time only those seedlings having tubers free, or almost free from scab are saved for increase.

These are subjected to selection on the basis of appearance in the field, and the ones saved are given an additional test later for disease resistance in the field.

Representative lots of desirable seedlings are sent to the cooperators to be tested for adaptability. These seedlings, which have been tested in the past with satisfactory results, are sent in sufficient quantities to cooperators to be included in yield tests. Since tests in the past have shown that northern-grown seed generally outyields the same varieties grown in Tennessee, we have decided to use only northern-grown seed for this purpose. Starting in 1951, we will ship desirable seedlings to South Dakota for increase. Tubers from these will be sent to the Southern States to be included in yield plots. By using northern-grown seed only it will be possible to evaluate these seedlings more accurately in comparison with the performance of the regular commercial varieties grown in the South, seed of which always is obtained from Northern States.

A yield plot of seedlings and varieties was maintained in southern Louisiana at Thibodaux (La. table 1). It is customary in this section to plant potatoes in rows 6 feet apart and to interplant with first-year sugar cane or corn. When the potato plants were about 10 inches high, a frost defoliated these. Undoubtedly some of the seedlings were more affected by this than others. Unfavorable weather conditions in the cooperating Southern States affected the yield of seedlings, giving unreliable results; for this reason, these yields are not reported this year.

On the basis of the performance of the varieties tested in the different locations in Louisiana, as shown in Louisiana table 2, it would be difficult to recommend one variety to be grown at the six different locations. DeSoto and LaSoda would probably give the best over-all yield.

The DeSoto seems to be best adapted to the sandy type of soil. Under these conditions, the tubers are well shaped, very smooth, and retain their color even during a wet season. LaSoda is better adapted to the medium and heavy soil types where no enlarged lenticels result. In sandy soils, the tubers are smooth, and the color fades during wet weather.

Louisiana table 3 lists the named and numbered varieties of potatoes sent this year to the various cooperating stations in the South to be tested for adaptability.

Louisiana table 1. Yield of Irish potatoes from Tennessee, grown at Thibodaux, La. Planting date, January 28, 1950; harvesting date, April 26, 1950.

Variety or number	Yield of U. S. No. 1 potatoes per acre
	Bu.
B 73-10	157
Kennebec	154
1703	126
401	122
677	118
649	117
659	117
666	110
Green Mountain	110
651	105
643	98
1690	92
Bliss	90
429	89
415	88
678	88
366	84
1701	77
652	75
679	74
667	74
658	71
414	55
1694	48
634	34
1700	31

L.S.D. = 25 bushels
Difference at 5-percent level.

Louisiana table 2. Variety yield test in six different locations in Louisiana

Variety	Location and yield per acre					
	Diamond	Thibodeaux	Hammond	New Roads	Calhoun	Baton Rouge
	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.
LaSoda	160	168	229	262	147	200
DeSoto	179	160	226	271	168	213
Katahdin	129	163	160	259	89	137
Triumph	84	91	212	200	107	146
Kennebec	166	155	197	266	123	178
L.S.D. at 5% lead =	28	26	28	37	33	27

Louisiana table 3. Named and numbered varieties sent to the various cooperating stations in the South.

State	Varieties	Resitant to blight only	Resistant to scab only	Resistant to blight and scab	No data on blight or scab
	No.	No.	No.	No.	No.
Alabama	10	3	1	1	5
Florida (Hastings)	16	9	2	0	5
Florida (Homestead)	17	5	4	0	8
Georgia (Mountain Station)	12	3	1	0	8
Mississippi	34	5	7	0	22
North Carolina	36	9	4	0	23
South Carolina	22	9	3	0	10
Texas	38	12	4	0	22
Virginia	6	3	3	0	0

U. S. - Colo. Potato Field Station (Greeley, Colorado)
W. C. Edmundson

The potato-breeding work for the year 1950 considted of breeding for scab resistance, together with better cooking quality, with both red and white varieties. Most of the parent material was supplied from Beltsville. To this was added the most promising lots developed at Greeley. A number of the seedlings supplied from Beltsville carried a factor for blight resistance.

The 1950 tests included the first-year seedlings in family lines, second-year seedlings in 5-hill lots, increase plot in 32-hill lots, the testing of older seedlings on a field basis, and a yield test of seedlings and new varieties.

In addition to test plots at the station, the more promising seedlings were tested on two farms in the early potato section at Gilcrest, Colo. Seedlings were also sent to the State stations at Rocky Ford and Monte Vista for testing by Dr. Robert Kunkel. Extensive tests for scab resistance were made by Dr. L. A. Schaal at different locations throughout the State.

The growing season of 1950 was very favorable for potato production. The yield per acre for the district was probably the largest ever obtained. Although the rainfall was about normal, the temperature for the season was below normal, there being many partly cloudy days. Because of new and better insecticides and fungicides, planting dates have been advanced giving a longer growing period.

Very little early blight was noted in the plots at the station, and only a trace of late blight was found on the plants or tubers. The psyllid population was very low in 1950 according to counts made of the psyllids in the check plot of the spraying experiment. All seedling plots were sprayed four times with DDT and Parzate or DDT and Dithane.

All family lines of the 1950 seedlings were planted about 2 weeks earlier than in past years at the station. The lots selected from these family lines will be planted in five-hill lots in 1951.

A large number of the five-hill lots were retained at time of harvest. These lots have since been carefully examined, and those infected with scab or indicating a tendency to growth crack were discarded. All lots that were retained for further test will be planted on a tuber-unit basis in 32-hill lots in 1951 and also placed in the scab test plots.

One hundred seventeen older seedlings were planted in 32-hill lots on a tuber-unit basis. All lots were retained at time of harvest for closer study. All of these lots were later spread out on the greenhouse benches and carefully examined for scab, growth cracks, and other defects. The best of these lots have been retained for planting at the station in 1951. Specific gravity readings were

made of the most promising seedlings to determine the cooking quality. Some of these seedlings were free from scab and look very promising. However, further tests will be necessary to determine their resistance. Dr. Robert Kinkel, of Colorado A & M College, has selected a number of the most promising seedlings for testing at other locations in the State.

Thirty-one of the older seedlings were planted on a field basis. Some were planted in half-row plots and some in full-row plots 535 feet long. Other seedlings were planted in larger lots. The plantings were on a tuber-unit basis. A few of these older seedlings appear to be very promising. Seedling 6362 produced tubers of a very good type, a good skin, shallow eyes, and a high percentage of No. 1 tubers. It is not scab-resistant, but develops much less scab than most commercial varieties grown in the district. Seedling 5244 is a promising scab-resistant seedling. The tubers are long with shallow eyes, and are inclined to grow a little irregular in shape. The worst features of this seedling are the large vines and lateness of maturity. This seedling also appears to be resistant to growth cracks and hollow heart. Of 100 large tubers taken at random, only 2 tubers had very slight growth cracks, and no tubers under 20 ounces had developed hollow heart.

Seed of 42 crosses was planted in flats in the greenhouse August 14, the seed having resulted from crosses made earlier in the year. Owing to the irregular germination of the seed, the plants were potted on three different dates; about 30 days elapsed between the first and last dates of potting. The seedlings that were potted on September 11 produced much larger tubers than the ones potted later. Seed from 18 crosses in which red parents were used were included in the plantings. However, only a small number of dark red tubers were obtained.

Twenty-eight seedlings and varieties were included in a yield test. Most of the lots have been tested for the past 3 years, although some new varieties were added in the 1950 test. The plots consisted of 25 hills, randomized and replicated 5 times. Greeley table 1 gives the mean total yield, the percentage of tubers above 2 inches, and the specific gravity. Fifty tubers from each of the 5 replications were used to determine the specific gravity of each lot. General tuber notes are also included in this report.

Many of the lots included in the yield test were also planted in the 32-hill plot. The specific gravity of most of the 32-hill lots was higher than that for the same variety grown in the yield test. This was probably because an extra irrigation was given to the yield test plot late in the season. Late irrigation generally increases the yield at the expense of quality.

Greeley table 1. Yield and specific gravity of potato seedlings and varieties grown at Greeley, Colo., 1950.

Variety or seedling	Mean total yield	Tubers by weight above 2 inches	Specific gravity
	Lb.[1]	Pct.	
Cherokee (61-3	68.6	96.94	1.0835
Kennebec (B 70-5)	88.1	97.62	1.0822
B 73-3	54.5	95.41	1.0789
B 73-10	75.5	98.15	1.0828
B 76-23	61.0	96.39	1.0752
B 99-56	57.5	93.39	1.0735
B 1276-185	69.2	92.34	1.0755
Mohawk	77.7	97.94	1.0830
Sebago	70.0	96.14	1.0878
Teton	89.8	95.88	1.0789
Cayuga	62.1	94.69	1.0869
Menominee	56.8	97.01	1.0739
Essex	75.8	95.78	1.0739
Virgil	71.7	97.63	1.0837
Placid	49.5	93.33	1.0785
Pawnee	60.7	97.20	1.0766
Katahdin	92.9	97.95	1.0850
CS 6320	46.6	96.78	1.0810
Chisago	69.1	96.24	1.0718
Yampa	75.9	93.81	1.0769
Progress	73.5	94.56	1.0775
Kasota	80.1	98.13	1.0726
Triumph	70.1	95.72	1.0718
Desota	83.1	93.98	1.0738
CS 5244	86.6	97.46	1.0789
CS 6362	64.0	98.28	1.0666
Waseca	56.6	94.35	1.0692
Satapa	81.0	97.90	1.0730
L.S.D. 5%	11.76	2.20	.0041
L.S.D. 1%	15.57	2.91	.0055

1/ Mean of five 25-hill plots.

COLORADO (Fort Collins)

Lawrence A. Schaal (U.S.D.A.)

The potato-breeding and testing continued as a cooperative effort between Colorado Agricultural Experiment Station and the United States Department of Agriculture. All crosses were made in the greenhouse at the U.S.-Colo. Potato Field Station, Greeley, Colorado, by W. C. Edmundson. First tubers from seed were produced and planted on the station plots. Selections from a number of family lines were grown in 5-hill lots. All selections from these, along with older selections, were included in scab test plots. Scab test plots were located at Gilcrest and Del Norte, Colo. Information on diseases other than scab was also noted; some information on adaptability was obtained. An increase plot was planted at Monte Vista, Colo. This plot will be used exclusively for testing and increasing all selections that appear to have merit.

The need for a better red variety of potato is still considered important by growers and dealers. Bliss Triumph and Red McClure are still grown as the red varieties. Pontiac is gaining in favor, but all leave much to be desired in a potato variety for the Colorado potato grower. The San Luis Valley needs an earlier maturing variety, either red or white, and at present none are available. This section produces the Red McClure almost exclusively. In the northern potato-producing section, and especially the early-crop district near Gilcrest, Colo., a substitute for Bliss Triumph and Irish Cobbler is greatly desired. Yampa produced an excellent crop of tubers in this early-crop district in 1950. This variety must be handled quite differently from Bliss Triumph and Cobbler, but when properly grown an excellent crop can be produced. Yampa is highly resistant to the races of scab found in this district, and scab-free crops were produced in soil where Triumph can no longer be grown.

Practically all crosses made for the past 3 years were those in which one or both parents have demonstrated some degree of scab-resistance. The variability of scab resistance from one section to another emphasizes the necessity of testing all new selections in the section in which they are to be grown. The number of parasitically different races appears to be more than was suspected. The resistance of a given variety may vary greatly from one section to another. In some cases farm-to-farm variation in susceptibility has been noted, but this is not common, and usually a variety will not vary from one local area to another. Each season a higher percentage of scab-resistant seedling selections is found, but the problem of combined disease resistance and of other desirable horticultural characters remains as difficult as ever.

Seedling material for testing was also supplied by Dr. F. J. Stevenson, Beltsville, Md.; Dr. C. E. Peterson, Ames, Iowa; Dr. W. G. Hoyman, North Dakota; and Dr. H. O. Werner, Nebraska. The lots from Dr. Werner were not included in the scab test plots, but were grown only in the adaptability and increase plot at Monte Vista, Colo.

Gilcrest, Colo. Plot

The seedling material grown in this plot is made up of selections from the 5-hill plot grown on the U.S.-Colo. Potato Field Station. A duplicate of each selection is grown in a 32-hill plot on the Station Farm. Thus, if a selection is found to be scab-resistant in this plot, a source of seed is available in the Greeley Station plot.

This plot was grown in soil that normally produces an unmarketable crop of Bliss Triumph or Irish Cobbler potatoes. Due to reasons unknown, scab was not as severe as usual in this soil, but susceptible varieties were quite uniformly and heavily scabbed. From the 164 lots tested, 19 were considered worthy of further testing. These are listed in Schaal table 1.

Table 1. Gilcrest, Colo., plot. Selections saved for further testing.

Variety or Seedling No.	Tuber color	Maturity	Scab data		Notes	Parentage
			Area 1/	Pust. type 2/		
CS 7846	Red	Medium	2	2	Good type & yield	CS 3245 x US 627-164
CS 6362	White	Medium	2	2	Good type & yield	Katahdin x Menominee
CS 8439	Red	Medium	2	1	Good type & yield	US 56-11 x CS 2439
CS 9887	Red	Medium	2	1	Good type & yield	CS 7137 x CS 4471
CS 9028	White	Medium	1	1	Fair type, high yield	CS 2436 x US 245-25
CS 10213	White	Medium	1	1	Good type & yield	CS 1119 x US 627-164
CS 10256	White	Early	3	2	Very good type & yield	Triumph x 627-164 (US)
CS 10269	White	Medium	2	2	Good type & yield	CS 4471 x US 245-186
CS 10587	White	Medium	2	2	Good type & yield	CS 5218 x CS 8859
CS 10638	Red	Medium	2	2	Good type & yield	CS 7990 x CS 7702
CS 10646	Red	Late	2	2	Good type & yield	CS 7990 x CS 7702
CS 10661	Red	Medium	2	2	Very good type & yield	CS 8859 x CS 7702
CS 10720	Red	Medium	1	2	Good type & yield	CS 8857 x CS 8859
CS 10724	Red	Late	2	1	Good type & Yield	CS 8857 x CS 8859
CS 10767	White	Late	2	2	Good type & yield	Houma x CS 6317
CS 10791	White	Medium	1	1	Good type & yield	US 245-121 x CS 7959
CS 10843	Red	Medium	2	2	Good type & yield	CS 7137 x CS 7202
Ia. 716-1	Red	Medium	1	1	Very good type & yield	
Ia. 45-11-7	Red	Medium	1	1	Very good type & yield	

1/ Surface area covered

1 = 1 to 20%
2 = 21 to 40%

2/ Type of pustule

1 = small superficial
2 = larger but still superficial

These selections will be increased and rogued carefully in 1951 to eliminate virus diseases in the seedling test plot in San Luis Valley.

San Luis Valley Increase and Test Plot

During the 1950 season the most promising seedling selections from the U.S.-Colo. Potato Field Station, several from Dr. H. O. Werner of Nebraska, and other named varieties were grown in a plot on the Monte Vista Experimental and Demonstration Farm. Most of the Colorado seedling selections were indexed in the greenhouse and unit planted. These lots were rogued several times in an attempt to remove all virus diseases. An unfavorable growing season precluded a normal test, but a good increase was obtained in some lots, which will permit yield and adaptability tests in 1951. Schaal table 2 lists the seedling selections and varieties grown in this plot.

Schaal table 2. Monte Vista, Colo., plot. Selections saved for further testing.

Variety or seedling No.	Tuber color	Notes
CS 5244	White	Late maturing
CS 6362	White	Medium small
CS 9887	Red	Ring rot?
CS 10110	White	Low yield
CS 10099	White	-----
CS 10128	White	----
CS 10065	White	Not a good type
CS 10185	Rus.	-----
CS 10267	Red	-----
CS 9028	White	Large tubers, high yield
CS 7287	White	Tubers small
Wyo. 4700	White	Good Yield
Kennebec	White	Heavy yield. Few small tubers.
White Cloud	White	--------
B. 96-56	White	A very good lot
B75-4	White	Some poor shape.
Neb. 140-42-1	White	-----
Neb. 204-43-1	Deep red	Russet skin. No scab.
Neb. 209-43-1	Deep red	Small. No 4 scab.
Neb. 213-43-3	Deep red	Many tubers small.
Neb. 38-32-3	Red	Many large tubers.
Neb. 25-42-2	Red	Tubers small
Neb. 120-40-6	White	Heavy set of tubers.
Neb. 60-44-1	Red	Heavy set, small tubers.
Neb. 213-43-2	Red	Many small tubers.
Neb. 311-43-1	Deep red	Not too good.
Neb. 225-43-1	Deep red	-----
Neb. 118-47-1	White	
Neb. 151-44-4	Red	Good McClure type.
N. D. 626	Red	Pontiac type.

Several of the Nebraska selections appeared to be well adapted to San Luis Valley conditions. Few varieties grow well in this high (7,600 feet) mountain valley. The Red McClure is grown almost exclusively, and very little of this variety is grown elsewhere. An early-maturing variety is greatly desired in this highly developed potato-growing section.

Del Norte, Colorado, Plot

Scab is a serious problem in certain parts of the San Luis Valley. Where it is present in soils, it is usually severe and heavily scabbed crops are produced. This plot is located on a farm where scab is severe. It is often a limiting factor in production of marketable Red McClure potatoes. Thirty-seven seedling selections and three named varieties were grown in this plot. Twelve of these were considered of sufficient promise to warrant further testing in this particular section of the San Luis Valley. Schaal table 3 lists those saved for further testing. A selection, B-515-2, supplied

Schaal table 3. Selections at Del Norte, Colo. saved for further testing 1951.

Variety or seedling No.	Tuber color	Maturity	Scab data		Notes
			Area	Pust type	
CS 6362	White	Medium	2	2	Uniform smooth tubers. Good yield.
CS 7846	Red	do	1	2	Smooth, uniform tubers. Fair yield.
CS 8439	do	do	2	1	Very uniform. Medium yield.
CS 9028	White	do	2	2	Uniform. High yield.
CS 9887	Red	do	1	1	Good type. Deep red. Good yield.
CS 10185	Russet	do	2	1	Smooth. Uniform. High yield.
CS 10383	White	do	2	2	Good type and yield.
B 515-2	do	do	1	1	Good type and yield.
Ia. 46-3-2	Red	do	1	1	Good type and yield.
Ia. 709-2	White	do	1	1	Very good type. Yield good.
Progress	Red	do	2	2	Good type & yield. Some growth crack.
Yampa	White	do	1	1	Good type. High yield.

by Dr. Hoyman of the North Dakota Agricultural Experiment Station grew quite well here and was free from scab infection. CS 9887 produced a good uniform yield of relatively scab-free tubers. One Iowa selection, furnished by Dr. C. E. Peterson, showed considerable promise. Many selections grown in this plot produced extremely large and rough tubers, and this character eliminates more selections than does scab susceptibility.

PACIFIC NORTHWEST

John G. McLean

Project title: Breeding and testing potatoes for resistance to verticillium wilt and scab and adapted to production under irrigation.

Project leaders: John G. McLean, Agent, U.S.D.A.; George W. Woodbury, Head, Horticulture Department, DeLance Franklin, Superintendent, Parma Station, Walter C. Sparks, Horticulturist, and Ralph Knight, Superintendent, Aberdeen Station, University of Idaho.

Importance of the problem: Verticillium wilt is believed to cause an average loss of 20 percent of the Russet Burbank crop in Idaho. In some areas the decrease in yield may approach 50 percent (McLean table 2). Verticillium and scab present a serious problem in many of the potato areas of the Northwest.

Objects: To produce verticillium- and scab-resistant or tolerant varieties that will be of a satisfactory market quality for the late potato-growing areas. To test and develop varieties suitable for production in the early districts.

Plan of work: It is planned to continue the screening of varieties and lines for their resistance to verticillium and scab. Such resistant lines, particularly those having different sources of resistance, will be combined by crossing, selfing, etc., where possible. Breeding parents and commercial types will be selected for further study and crossing. It will be possible in the future to grow about 10,000 seedlings and to conduct much of the breeding work at Aberdeen. Seedlings grown at Beltsville, Md., and in Iowa by Dr. Stevenson and Dr. Peterson, respectively, provided over two-thirds of the 14,000 seedlings that were grown the past year. It is hoped that further leaf roll, net necrosis, and scab tests may be started in the near future.

Location: The breeding and early testing of lines will be done at the Aberdeen, Idaho, station where scab and verticillium are both present. Testing for early varieties and seedlings will be accomplished at the Parma, Idaho, station where leaf roll tests may also be instituted. Verticillium resistance trials will be continued on the Egin bench, near Rexburg, Idaho, where this disease is both severe and well distributed. The plot for seed stock maintenance and breeding at Tetonia, Idaho, will be continued although it was severely frosted this season. Further adaptability tests may be located at Lewiston, Burley, etc., and scab trials may be instituted on more uniformly scabby soils.

Results to date: Several lines have been found that appear to be highly resistant to verticillium. Fortunately, several of these are also scab resistant. It appeared that a correlation existed between lateness of the line of potatoes and the amount of verticillium infection. Most of the resistant lines are late maturing and no highly resistant lines have been found in early strains of potatoes. The most resistant lines with the average index of verticillium infection are listed in McLean table 1.

An analysis of variance on 90 varieties divided into three maturity groups at two locations showed a significant difference between maturity groups and between locations when measured by the average index of verticillium infection.

McLean table 1. Lines resistant to verticillium wilt at two locations.

Line	Average verticillium index at: Rexburg	Aberdeen
Medium maturity (average index)	54.6	21.8
41956	15.7	1.0
Libertas	20.0	2.2
Late Maturity (average index)	37.2	13.7
B577-132	9.7	6.6
B792-88	8.7	2.5
B986-8	3.5	0.8
Voran	8.5	5.0
Prisca	13.3	3.7
Furore No. 1	4.0	4.7
Very Late Maturity (average index)	23.4	8.8
Sequoia	7.1	0.4
AC. 25669	5.3	0.5
Menominee	6.3	1.5
X528-170	14.7	4.0
Aquila	10.2	2.5
Skerry Champion	8.0	2.5
Friso	3.6	1.6
Iduna	12.7	2.5
Wilpo	10.3	1.4
Jubel	17.0	1.2
Saranac	1.8	0.3
Populair	0.3	0.0

From the results of the verticillium trial plot on the Egin bench near Rexburg, Idaho, it appeared that this disease is probably the limiting factor in potato production in the area. (McLean table 2). A highly significant correlation of -0.8364 was obtained between the yield and the average verticillium index. It appeared that irrespective of yielding ability elsewhere that some resistance was necessary to produce a sizeable crop of U. S. No. 1 potatoes.

The trial was conducted on land that had been in potatoes 2 years previous to the test and had received no fertilizer. During the course of the experiment, the irrigation water was withdrawn from the plot when the crop of Russet Burbank in the field had been matured by the disease. This, together with early planting, broke down the apparent resistance in Mohawk, Green Mountain, and Pontiac, but left Menominee, Sequoia, Saranac, and others relatively unaffected.

McLean table 2. Yield, verticillium index, specific gravity and percentage U. S. No. 1, at Rexburg, Idaho.

Variety	Sacks per acre	Average Verticillium index	Specific Gravity	U. S. No. 1
	No.			Pct.
Sequoia	553.6	7.1	1.0842	85.9
Ac. 25669	504.6	5.3	1.0858	78.9
Cayuga	468.3	36.1	1.0903	73.8
Ac. 25671	462.8	13.0	1.0825	95.9
Menominee	439.2	6.3	1.0882	71.5
White Rose	402.9	49.7	1.0767	56.4
Saranac	363.0	1.8	1.0888	81.7
Green Mountain	332.0	45.0	1.0868	87.8
Craigs Bounty	319.4	34.0	1.0941	83.3
Mohawk	312.2	36.1	1.0852	68.0
Pontiac	304.9	58.7	1.0798	82.5
Record	268.6	28.3	1.1000	84.5
Cobbler	252.3	70.5	1.0799	68.2
LaSalle	245.0	55.0	1.0782	69.7
Progress	232.1	74.0	1.0831	37.5
Houma	197.8	73.0	1.0879	73.1
Russet Burbank(late)	196.0	75.0	1.07668	56.4
Russet Burbank(early)	174.2	76.7	1.08561	57.2
Red Warba	163.4	69.0	1.0911	60.4

Correlation of yield and average index, r = -0.8364.

The majority of the samples tested at the Aberdeen, Idaho, station fell in classes of 21 to 60 percent of type 5 lesions. The pits of these lesions were usually 0.5 to 1 centimeter in diameter and frequently 1 centimeter deep.

Most of the lines which showed resistance to scab at this location were from Jubel or Hindenburg parentage although a few "escapes" were noticed such as 46952 and ND179-25. (McLean tables 3 and 4)

McLean table 3. Scab at the Aberdeen Station.

Type lesions	Percent
0 or trace	6.1
1	5.8
2	9.0
3	6.1
Unmarketable	73.0

McLean table 4. A list of scab-resistant lines at Aberdeen.

No scab	Trace of scab	Slight scab
Menominee	Potomac	Seneca
Jubel	Ac 25669	Hindenburg
Ac. 25680	Yampa	Triumf
Ackersegen	C.S.6344	46952
Cayuga	B385-5	D-180
C.S.10,185	B608-66	B287-2
C.S.6316	B929-37	B313-21
B400-1	B962-26	
B961-17	B1113-393	B461-32
B962-22	B1113-398	B1113-245

McLean tables 5 and 6 give data on yield, verticillium, and specific gravity of the varieties grown at Aberdeen, Lewiston, and Parma, Idaho.

McLean table 5. Yield, verticillium index, and specific gravity of varieties at Aberdeen, Idaho. Sparks and McLean.

Variety	Yield sacks per acre	Verticillium index	Specific gravity
Menominee	350.5	1.5	1.1027
Russet Burbank	327.0	29.3	1.0917
Green Mountain	319.7	7.1	1.0974
Russet Rural	318.3	6.6	1.0930
White Rose	284.0	22.3	1.0909
Mohawk	274.7	6.1	1.0923
Progress	270.9	33.6	1.0865
Cayuga	226.3	10.0	1.1070
B515-2	250.3	34.9	1.0784

McLean table 6. Yield, grade and specific gravity of varieties at Lewiston and Parma, Idaho. Woodbury, Franklin, and McLean.

Variety	At Parma			At Lewiston		
	Yield per acre	Yield per acre U.S. #1	Specific gravity	Yield per acre	Yield per acre U.S. #1	Specific gravity
	Sacks	Pct.		Sacks	Pct.	
Kennebec	242.1	88.4	1.092	439.3	50.7	1.097*
D. R. Pontiac	246.8	81.0	1.071	472.6	63.9	1.087
Earlaine	160.4	71.3	1.098			
Yampa	140.8	80.1	1.090	310.0	55.6	1.093
White Rose	244.7	73.0	1.088	426.5	37.5	1.087
Progress	226.9	81.9	1.094	444.0	70.1	1.091
Erie	151.4	76.5	1.088	378.8	59.9	1.096
Red Warba	185.1	91.9	1.097	454.6	70.8	1.075
Green Mountain	202.6	72.3	1.099	410.6	67.8	1.097*
Houma	170.6	77.6	1.116	333.9	66.0	1.087
Pawnee				253.5	64.7	1.080
Cobbler				365.2	48.9	1.087
Katahdin				274.1	49.8	1.092
46952				241.7	57.0	1.076
1276-185	185.1	84.9	1.084			
B515-2	201.1	87.0	1.087	315.5	45.9	1.080
Minimum difference required for significance 19:1	44.6			42.9		

* Specific gravity is slightly higher than is indicated by average.

Differences in specific gravity ranged from 1.0640 for 46952 to 1.1260 for Noordeling. Most of the values are relatively high as compared with those reported from other parts of the United States. (McLean table 7).

The field on which these were grown received manure and 200 pounds per acre of 16-20-0 fertilizer previous to planting. A small amount of 2,4-D was applied by mistake from a contaminated sprayer at the time the first blossoms appeared. This may have had an effect of increasing specific gravity.

McLean table 7. Specific gravity at Aberdeen. (Varieties and lines not listed in other tables.)

Standard varieties		High starch varieties	
Yampa	1.0932	Freuhnudel	1.1067
C.S.6330	1.0924	Ulster Cromlech	1.1095
DeSoto	1.0915	Voran	1.1162
Katahdin	1.1042	Mittlefruhe	1.0971
Erie	1.0927	Great Scott	1.1013
Teton	1.0916	Aquila	1.1104
Empire	1,1060	Hindenburg	1.1160
Early Menominee	1.1027	Skerry Champion	1.1154
Late Menominee	1.0954	Noordeling	1.1260
Early Russet	1.0917	Saskia	1.0821
Late Russet	1.0945	Matador	1.1059
Red Warba	1.0874	Saranac	1.0934
Sequoia	1.0975	Duivelander	1.0996
Houma	1.0889	Iduna	1.1074
N.D.179-25	1.0869	Ljesselster	1.1026
1276-185	1.0819	Flava	1.1006
Cobbler	1.0920	Starkeragis	1.1228
46952	1.0640	Furore No. 8	1.1051
Earlaine	1.0742	Alpha	1.1056
Potomac	1.1017	Prisca	1.1103
		Eigenheimer	1.1027
Seedling lines			
B446-25	1.0799	Libertas	1.1142
B400-1	1.0990	Populair	1.1235
B287-2	1.1034	Jubel	1.1105
B56-11	1.0982	Wilpo	1.1129
B487-1	1.0890	Thijn	1.1074
B627-49	1.1121	Up-to-date	1.1000
B294-38	1.1162	Ultimas	1.1054
B962-22	1.0941	Koopermans Blauwe	1.1048
B792-88	1.0937	Sport of Furore	1.1118
B2073-11	1.0853	Roode Star	1.1223
B1127-97	1.0875	Triumf	1.1065
B922-10	1.0920	Friso	1.1060
X96-44	1.0866	Rheingold	1.1090
B2102-11	1.1001	Erdgold	1.1060
B490-1	1.1028	Record	1.1100
B2098-15	1.0928	Albion	1.0977
B924-13	1.0786	Parnassia	1.1205
B67-1	1.1059	Aussie	1.0992
B864-30	1.1007	Freuhgold	1.0890
B922-3	1.0834	Epicure	1.0887
B922-5	1.0833	Ostbote	1.1193
B725-8	1.0765	Sport of Furore #1	1.1110
X792-88	1.0928	Ulster Ensign	1.0859

McLean table 7 continued

Seedling lines	Specific gravity
B313-16	1.0835
B986-8	1.0851
B962-26	1.0932
B385-5	1.0961
B920-8	1.0966
B929-39	1.0866
B2067-25	1.0980
B724-1	1.0854
B577-44	1.0837
X245-186	1.1005
B400-1	1.0946
B577-132	1.0857
B986-7	1.0952
B915-3	1.0874
X245-186	1.0937
B56-9	1.0819
B73-2	1.1011
B381-2	1.1080
B461-32	1.1020
B961-17	1.0872
B926-9	1.0915
B2083-96	1.1002
B137-5	1.0904
B294-29	1.0875
B724-20	1.0851
B528-170	1.1066

California

Glen H. Davis

In 1950 potato plots were planted at Shafter and Hollister.

Shafter. Three plots were planted at Shafter. The variety yield test consisted of 17 varieties and 15 seedlings. Five replications of each (25 seed pieces in 25 feet of row) were randomized in the block. White Rose was used as the check. Only one lot, seedling, B73-16, gave a significantly higher yield than the check. Several were lower. The results are given in table 1.

Calif. table 1. Potato variety yield test, Shafter, Calif., 1950

Kind	Mean Yield
	lb.
Katahdin	46.4
White Rose	42.0
Canus	35.8
De Sota	35.4
Essex	43.0
Huinkul	46.6
Kennebec	45.8
LaSoda	39.0
Mohawk	49.0
Pontiac	41.6
Progress	34.8
Red Warba	31.8
Russet Sebago	40.6
Sebago	39.8
Saranac	40.0
Satapa	48.2
Teton	39.8
B37-10	31.8
B73-2	39.8
B73-10	38.0
B76-42	62.8
B355-44	44.2
B402-1	25.8
B446-8	40.2
B447-98	25.0
B606-10	37.6
B606-67	33.4
B637-14	36.4
B639-10	32.6
2891	25.6
96-56	29.4
B73-16	62.8

Least sig. diff. between means, 12.33 lb.
Least highly sig. diff. between means, 16.39 lb.

Two plots to test for scab resistance were planted. One plot was on the U.S.D.A. Cotton Station, the other in a field belonging to the A. A. Camp Co. The latter is so scabby that it has been abandoned for commercial potato production. Readings on the Station plot were not conclusive so were discarded. Excellent readings were obtained in the Camp field and are presented in Calif. table 2.

Calif. table 2. Potato scab resistance test plot, Shafter, Calif., 1950

Kind	Tubers	Tubers in class rating								Ave.	Type lesion	Marketable*
		0	1	2	3	4	5	6	7			
	No.	No.	No.	No.	No.	No.	No.	No.	No.			Pct.
White Rose ck.	29	5	2	1	--	3	3	11	5	4.2	2	27
Menominee	20	20	-	-	--	-	-	--	-	.0	-	100
Ontario	20	--	14	-	5	1	-	--	-	1.6	2-3	70
B56-1	25	--	15	4	2	4	-	--	-	1.8	3	76
B920-12	21	5	2	5	1	6	2	--	-	2.3	2	57
B2100-7	17	1	2	5	9	-	-	--	-	2.3	2	47
B2161-3	29	--	3	5	21	-	-	--	-	2.6	4	27
B2102-13	34	--	3	4	18	8	1	--	-	3.0	3-4	20
B2102-8	19	--	1	4	5	9	-	--	-	3.1	3	26
B2067-25	17	--	2	2	6	5	2	--	-	3.2	1-2	23
B2162-18	17	1	1	3	4	4	3	1	-	3.3	1-3	29
B2162-11	25	--	2	4	5	13	1	--	-	3.3	2-3	24
B528-170	22	--	-	2	15	3	1	1	-	3.3	2-3	9
B2159-1	27	--	2	5	7	5	6	2	-	3.5	3	25
B400-1	30	1	3	4	3	10	8	1	-	3.5	2	27
Rheingold	27	0	1	2	10	9	5	-	-	3.5	2	11
B991-13	24	-	-	5	4	10	4	1	-	3.7	2	21
B2083-6	30	-	2	3	1	20	4	-	-	3.7	3	17
245-186	25	-	-	2	6	11	6	-	-	3.8	3	8
B2102-11	23	-	1	3	5	7	6	1	-	3.8	2	17
B2067-133	25	-	3	1	3	3	10	-	-	3.8	2	16
B962-16	21	-	-	5	1	9	6	-	-	3.8	3-4	24
627-49	29	-	1	3	5	14	4	2	-	3.8	3	14
B2070-42	33	-	2	4	1	14	9	3	-	4.0	2	18
Arnica	33	1	-	2	5	15	8	2	-	4.0	3	9
B38-16	27	1	-	-	5	10	11	-	-	4.1	1	4
Jubel	27	-	1	1	4	10	11	-	-	4.1	2	7
B2067-23	28	-	1	1	1	9	10	4	1	4.1	1-3	7
B81-16	55	-	1	5	9	17	20	3	-	4.1	2	11
Hindenburg	32	-	-	-	4	20	8	-	-	4.1	3	0
B961-20	20	-	-	-	3	12	3	2	-	4.2	3	0
B262-49	19	-	-	-	6	4	9	-	-	4.2	2-4	0
B2173-22	20	-	-	4	1	6	2	7	-	4.3	2-3	20
B962-9	29	-	3	1	1	8	10	6	-	4.3	2-3	14
R. Sebago	27	-	-	1	4	10	11	2	-	4.3	3	3
B56-11	25	-	2	4	1	4	3	11	-	4.4	2	24
B874-24	28	-	-	-	2	10	15	1	-	4.5	1-2	0
B41-4	22	-	-	-	-	10	10	2	-	4.6	2-3	0
R. Burbank	21	-	1	-	2	6	4	8	-	4.7	2	5
B962-3	19	-	-	1	1	4	8	5	-	4.8	2-3	4
B44-14	29	-	1	2	1	5	7	13	-	4.9	2-3	10
B2073-11	24	-	3	1	2	8	9	1	-	4.9	2-3	17
B920-7	13	-	-	-	1	2	8	2	-	5.0	2	0
R. Rural	22	1	-	1	-	2	6	12	-	5.1	1-2	9
B2070-27	33	-	-	-	4	7	14	8	-	5.1	1-2	0

Continued Calif. table 2.

Kind	Tubers	Tubers in class rating								Ave.	Type lesion	Marketable*
		0	1	2	3	4	5	6	7			
	No.	No.	No.	No.	No.	No.	No.	No.	No.			Pct.
B962-1	20	-	-	-	1	2	10	5	2	5.2	2	0
Seneca	24	-	-	1	1	2	7	13	-	5.2	2-3	4
R. Sebago	25	-	1	-	3	1	5	15	-	5.3	2	4
Cayuga	24	-	-	-	-	1	14	8	-	5.3	2-3	0
B61-3	23	-	-	-	1	1	7	14	-	5.4	3	0
B2140-19	16	-	-	-	-	1	7	8	-	5.4	1-2	0
B991-3	21	-	2	-	-	3	1	7	8	5.6	1-3	9
B62-1	25	1	1	-	2	-	2	9	10	5.6	1-2	8
B759-26	13	-	-	-	1	3	6	2	3	6.0	1	0
Yampa	13	-	-	-	-	-	1	12	-	6.0	3	0

Key to classes:

0 = free from scab
1 = 1% of surface area covered with scab (trace)
2 = 5% " " " " "
3 = 15% " " " " "
4 = 25% " " " " "
5 = 35% " " " " "
6 = 60% " " " " "
7 = 90% " " " " "

* Only classes 0, 1, and 2 considered marketable.

Scab readings were on a slightly different basis than in previous years. The change was made to be in harmony with the system used by the members of the Division of Plant Pathology. It will be noted that of the 13 varieties and 41 seedlings tested only 3 lots, Menominee, Ontario, and B56-1, showed sufficient resistance to be of commercial importance. It was gratifying, however, to find resistance to the strain of scab present in California soils.

Representative tubers of 16 selected lots are pictured in Fig. 1.

Hollister

In the Hollister district, practically the entire crop is placed in storage at digging and later sold for chipping purposes. The main variety is Netted Gem; however, some White Rose is grown.

Potatoes in this area suffer from a so-called early decline, which was found to be caused by verticillium wilt. The disease causes a premature death of the plants, resulting in a considerable reduction in yield when based on what might be expected if the crop grew normally for another 30 days.

Fig. 1. Representative tubers from 16 different lots of potatoes included in the scab resistance list on the S. A. Camp farm at Shafter, Calif. in 1950.

Sixteen varieties were planted in the yield test at Hollister. The Netted Gem checks were accidentally lost, so the commercial yield from the field surrounding the plot was accepted as the check. The data on yield are presented in Calif. table 3. Twenty-five pounds of each variety were sent to a chipper for chipping tests.

Calif. table 3. Potato yield test, Hollister, Calif. 1950 1/

Kind	Mean Yield
	lb.
Mohawk	48.0
Pontiac	45.7
Kennebec	42.0
Huinkul	42.0
Saranac	41.7
Teton	41.0
De Soto	39.6
Sebago	39.0
Essex	38.2
Red Warba	38.1
Progress	31.5
La Soda	33.8
Katahdin	32.7
Satapa	30.1
Canus	27.2
Iduna	25.4

Least sig. dif. = 8.4 lbs.
Least highly sig. dif. = 11.2 lbs.

1/ Netted Gem check at 210 sacks per acre = 32.8 lbs. in 25 feet of row.

In addition to the yield tests, 29 named varieties and 76 numbered lots were tested for resistance or tolerance to verticillium wilt. In 1949 the lots tested were classified as either resistant or susceptible, based on the invasion of the roots and stems by the wilt organisms and without regard to the condition of the tops at the time the readings were taken. The 1950 readings were taken somewhat differently. The condition of the tops was noted (G, green growing; I, partially dead; and D, completely dead), and the degree of invasion of the roots and stems by the wilt organism was recorded (0, clean to a trace of discoloration; 1 mild infection; and 2, badly diseased).

The condition of the tops may have been affected somewhat by the natural maturity of the lots in question. However, the readings were taken 94 days after planting, and it is felt that all lots would have still been green and actively growing after this period had it not been for verticillium wilt. All commercial fields of Netted Gem were dead at this time.

From the observations made in 1950, it appears that some lots exhibit considerable tolerence to verticillium wilt and may proceed to produce a good yield of potatoes, although heavily infected with wilt organism. Results of the readings are presented in Calif. table 4.

Calif. table No. 4. Verticillium resistance test, Hollister, 1950.[1/]
Reading 9/13/50

Kind	Condition of vine	Degree of inf.	Kind	Condition of vine	Degree of inf.
Ackersegen	G	2	B76-20	D	2
Arnica	G	0	B76-23	D	2
Canus	D		B76-43	D	2
Cayuga	I	2	B96-56	D	2
De Sota	I		B245-186	I	2
Essex	I		B355-44	G	0
Hindenburg	I	2	B400-1	I	2
Huinkul	G		B402-1	D	2
Iduna	I	0	B446-8	I	2
Jubel	G	1	B447-98	D	2
Kennebec	G		B528-170	I	1
La Soda	D		B529-88	I	1
Menominee	G	1	B595-76	G	2
Mohawk	G		B595-87	I	2
Netted Gem	D	2	B606-10	I	2
Ontario	G	1	B606-67	I	2
Pontaic	G		B627-49	G	2
Progress	I		B637-14	D	2
Red Warba	D		B639-10	I	2
Rheingold	I	1	B738-16	D	2
Russet Burbank	D	2	B738-17	I	1
" Rural	I	2	B759-26	D	2
" Sebago	G	0	B778-43	I	2
Saranac	G		B780-27	I	2
Satapa	D		B874-24	D	2
Sebago	G	1	B884-19	I	2
Seneca	I	1	B919-2	G	2
Teton	D		B919-15	G	0
Yampa	G	2	B919-21	D	2
B38-16	D	2	B920-7	D	2
B41-4	I	2	B920-12	D	2
B44-14	I	0	B926-9	I	2
B56-1	I	2	B929-32	D	2
B61-3	I	2	B931-2	D	2
B62-1	D	2	B936-12	I	2
B73-2	I	2	B939-10	D	2
B73-10	I	1	B939-16	D	2
B73-16	I	2	B944-5	I	2
B73-18	I	2	B959-76	I	2
B75-4	D	2	B962-3	G	1

Calif. table 4 continued

Kind	Condition of vine 1/	Degree of inf 2/	Kind	Condition of vine 1/	Degree of inf. 2/
B962-11	D	2	B2102-8	D	2
B962-16	I	2	B2102-11	G	0
B982-8	G	0	B2102-13	G	0
B982-16	G	1	B2135-28	G	0
B991-13	I	2	B2140-19	D	2
B991-30	D	2	B2159-1	G	2
B2067-25	G	0	B2161-3	G	1
B2067-133	G	2	B2162-18	G	2
B2070-27	I	2	B2162-49	G	1
B2070-42	G	0	B2173-22	G	0
B2073-11	D	2	13962-9	I	1
B2083-6	G	1	Ac.25673	G	0
B2100-7	D	2			

1/ G = Vine green, standing, still growing.
D = " dead.
I = " partially dead.

2/ 0 = Stems when cut, clean to trace of discoloration.
1 = " " " show intermediate discoloration.
2 = " " " badly discolored due to fungus attack.

CONNECTICUT

Arthur Hawkins

	Variety	Yield per acre						
		Total	Over 1 7/8"		2 1/4"-4"		2 1/4"-4" Free of offshape*	
		Bu.	Pct.	Bu.	Pct.	Bu.	Pct.	Bu.
				Ellington 1/				
1	Kennebec	704	97.0	683	85.1	599	80.1	564
2	Teton	622	97.6	607	87.9	547	87.7	545
3	Chippewa	642	95.2	611	83.3	535	83.1	534
4	Ontario	751	91.3	686	75.5	567	70.0	526
5	Katahdin	626	97.1	608	82.8	518	82.7	518
6	Sebago	592	94.2	558	85.3	505	84.9	503
7	Mohawk	576	98.4	566	87.3	503	82.7	476
8	Green Mountain	638	96.5	616	88.4	564	67.3	429
	L.S.D. .05			62				
	L.S.D. .01			84				
				Windsorville 2/				
1	Kennebec	833	96.7	806	87.2	726	85.2	710
2	Green Mountain	811	96.3	781	89.4	725	86.2	699
3	Teton	775	97.2	754	89.0	690	88.1	683
4	Mohawk	761	98.5	750	87.1	663	84.7	645
5	Katahdin	740	95.9	710	85.4	632	85.1	630
6	Ontario	842	89.5	754	78.7	663	74.6	628
7	Sebago	730	94.0	687	84.9	620	84.6	618
8	Chippewa	698	93.3	652	82.8	578	82.3	574
	L.S.D. .05			50				
	L.S.D. .01			67				

*Serious offshape removed.

Size of Plots: 2 rows, 21 feet long. Replication: 8.

Spacing: All varieties spaced 9 inches apart, except Ontario spaced 11 inches, in 36-inch rows.

Location of Tests:

1/Earl Hatheway, Ellington, Connecticut. Planted: May 12, 1950. Green until freeze, September 24.

Soil: Hartford fine sandy loam. Good stand rye cover 18 inches high plowed under

Fertilizer: 1000 pounds castor pomace per acre broadcast and harrowed in before planting; 1900 pounds 8-12-12 per acre, side-band placement.

2/Emil Mulnite, Windsorville, Connecticut. Planted: May 8, 1950. Chippewas

about gone, Kennebec going fast, and Ontario very green September 15. Killing freeze September 24.
Soil: Manchester fine sandy loam; potatoes grown previous five years; rye 6 inches high plowed under.
Fertilizer: 1200 pounds castor pomace per acre, broadcast and harrowed in; 2800 pounds per acre 5-8-7 in row, side band placement.

Source of Seed: Seed supplied through cooperation of R. V. Akeley, Horticulturist, Division of Fruit and Vegetable Crops, U. S. D. A., except Ontario which was also grown in Maine.

Variety	Specific Gravity - Average of 8 samples 1/	
	Farm 1 Ellington, Conn.	Farm 2 Windsorville, Conn.
1 Green Mountain	1.077	1.088
2 Mohawk	1.072	1.083
3 Kennebec	1.068	1.078
4 Ontario	1.066 2/	1.077 3/
5 Sebago	1.066	1.074
6 Katahdin	1.065	1.072
7 Teton	1.063	1.074
8 Chippewa	1.062	1.071

1/ 10 to 12 tubers per sample
2/ 16% of tubers had spots of slight red discoloration...blossom end
3/ 80% of tubers had spots of moderate to severe red discoloration

Single Sample from Plots 2 rows 10 feet long - Farm #1

		Yield Bu./ Acre	
		Total	Over 1 7/8"
Ontario	1.0667	777	773
Essex	1.0595	967	964 - 4% off shape
B 355-44	1.0765	472	461 "
B 637-14	1.0627	738	738 - 10% over 4"
Marygold	1.0726	949	936 - Smooth; 15% over 4"
Idaho Russet	1.0745	582	487 - 25% off shape: 16% under 1 7/8"

DELAWARE

E. P. Brasher

Irish Potato Variety and Strain Trials in 1950

Thirty-five varieties and strains of potatoes were tested on the University farm at Newark to determine the productivity of new varieties and of different strains of certain standard varieties.

The experimental procedure and conditions were as follows:

Soil: Sassafras loam.

Plot Size: 25 x 3 1/2 feet (29 seed pieces per 25 feet of row).

Plot Design: Randomized block.

Replications: Five.

Planting Date: April 6, 1950.

Fertilizer: 1400 pounds per acre of 8-16-16 in bands.

Fungicide: Dithane Z-78.

Insecticide: DDT.

Growing Conditions: There was an adequate and uniform distribution of moisture until 3 weeks before harvest. The soil then became quite dry and probably reduced the yield of late-maturing varieties but had no effect on the early varieties. The temperature throughout the growing season was considered good.

Harvesting Date: August 29, 1950.

The results of this test (Delaware table 1) shows that the yield of No. 1 potatoes varied from a low of 117 bushels per acre to a high of 374 bushels. The 6 highest-yielding varieties, in the order of their productivity, were: Essex, Pontiac, Marygold, B73-18, Irish Cobbler, and Kennebec. Among these varieties there was no significant difference in yield. The yield, however, of No. 1 potatoes from Essex was significantly greater than from any of the remaining 29 varieties and strains tested.

Delaware table No. 1. Results of potato variety and strain trials, Delaware Agricultural Experiment Station, Newark, Delaware, 1950.

Variety	Seed Source	Yield per acre 1/		Rank
		U.S. No. 1	U.S. No.1+No. 2	U.S. No.1
B69-16	Stevenson,U.S.D.A.	294	352	12
B73-18	Do	323	343	4
B75-4	Do	192	235	29
B76-43	Do	269	303	20
B355-44	Do	289	327	14
B637-14	Do	277	313	16
1276-185	Do	293	350	13
Cayuga	Do	173	268	31
Chippewa	Do	289	351	15
Essex	Do	374	432	1
Green Mountain	Do	249	294	25
Houma	Do	245	338	26
Irish Cobbler	Do.	319	370	5
Katahdin	Do	300	343	9
Kennebec	Do	316	360	6
Marygold	Do	326	391	3
Mohawk	Do	301	321	8
Ontario	Do	130	226	34
Pontiac	Do	327	375	2
Progress	Do	117	275	35
Red Warba	Do	256	349	24
Sebago	Do	269	313	21
Seneca	Do	218	294	27
Sequoia	Do	185	251	30
Teton	Do	294	366	11
White Rose	Do	267	314	22
Irish Cobbler	Minn. Dept.of Agr.	266	351	23
Chisago	Do	270	293	19
Sebago	Do	193	238	28
Katahdin	Do	271	305	18
Waseca	Do	297	342	10
Pontiac	Do	305	364	7
Red Warba	Do	276	336	17
Ontario	Eastern States	150	283	33
B61-3	Jehle, U. of Md.	168	267	32
L.S.D. 5% Level		63	66	
L.S.D. 1% Level		84	87	

1/ Average for five replications.

Of the six highest-yielding varieties, Essex, B73-18, and Kennebec appear to be the most promising for Delaware. All three of these varieties are resistant to late blight and are of acceptable market quality. B73-18, which originated from a Mohawk x (X96-56) cross, is particularly attractive. Pontiac and Marygold are objectionable because they are, respectively, red and yellow in color.

The strains of potatoes from the U. S. Department of Agriculture, in general, were more productive than those from the Minnesota Department of Agriculture. In only one of these comparisons, however, was the yield difference of No. 1 potatoes great enough to be significant. This occurred between the two strains of Sebago.

FLORIDA

A. H. Eddins, E. N. McCubbin and R. W. Ruprecht

Eleven varieties and crosses were tested for yield at Hastings, and seven varieties and crosses were tested at Sanford, (Fla. table 1). The potatoes were sprayed regularly with dithane-zinc sulfate and DDT spray to protect them against late blight and insects.

Dakota Chief and cross B351-44 significantly outyielded Sebago at Hastings. Differences in yields of B73-10, B605-10, B61-3, B76-43, and Kennebec were not significant. Essex, Ontario, and B278-27 yielded significantly less than Sebago.

Dakota Chief also ranked first in yield in the Sanford test by producing 507 bushels per acre, and Ontario ranked lowest with 433 bushels. However, the experimental error was very high in the Sanford plots, and none of the differences in yield between varieties is significant.

Ten pounds of tubers of each variety and cross were examined for defects. The most general defect observed was checking of the skin of some of the tubers of B351-44, B605-10, B73-10, B76-43, and Kennebec. Twenty percent of the tubers of B605-10 had developed mechanical cracks one-eighth inch or more in depth during harvesting and grading. Tubers of Essex were immature and feathery, and 10 percent of the tubers of Ontario were misshapen. No tuber defects were observed in the other five varieties and crosses.

Table 1. -Yields of potato varieties and crosses grown at Hastings and Sanford, Florida, in 1950

Variety or Cross*	Bushels U. S. No. 1 tubers per Acre **			
	Hastings		Sanford	
	Total	Increase over Sebago	Total	Increase over Sebago
Dakota Chief	374	55	507	46
B351-44	359	40	--	--
B605-10	325	6	--	--
B73-10	323	4	455	-6
Sebago	319	--	461	--
B61-3	319	--	505	44
B76-43	309	-10	--	--
Kennebec	291	-28	471	10
Essex	254	-65	488	27
B278-27	174	-145	--	--
Ontario	169	- 150	433	-28
Least Significant Difference		38		158

*Five replicates of each grown in 25-foot, single-row, randomized plots with rows spaced 40 inches apart at Hastings and 30 inches apart at Sanford.

**Also includes U. S. No 1A tubers.

IOWA

C. E. Peterson, W. J. Hooker and Roland G. Timian

The most important potato problem in Iowa is common scab. Cobbler is still the most widely grown variety, but it is becoming more and more difficult to produce an acceptable grade of potatoes with this variety. Growers in Iowa are showing an increasing interest in finding a variety to replace Cobbler. Among other disease problems, late blight, mosaic viruses, leaf roll, and ring rot are receiving greater attention in the breeding program. These diseases are controlled quite successfully by the generally accepted methods. However, because of the great advantages of natural resistance, efforts are being made to incorporate resistance to these diseases to whatever extent is possible without too greatly sacrificing chances for securing scab resistance with acceptable plant tuber characteristics. In addition to disease resistance, a great deal of attention is given to development of earliness, yield, and cooking quality.

Objectives

The five principal objectives of the program being developed in Iowa are as follows:

1. Production of commercially acceptable varieties having resistance to disease and adapted to muck-land production in northern Iowa and similar areas.

2. Evaluation of parent material and development of improved parent strains.

3. To develop methods for screening seedling progenies for resistance to disease.

4. To study disease problems that are fundamental to the breeding work.

5. Production of new seedlings and maintenance of disease-free stocks of advanced selections for testing and for distribution or exchange with other States.

Plan of work

Each year seed is produced from cross- and self-pollinations made in the greenhouse at Ames. Most of the crosses include resistance to both scab and late blight. The exceptions are those made for other disease studies. Each year a crop of seedlings grown in the greenhouse at Ames provides about 18,000 tubers for planting at Clear Lake, Iowa, and about 10,000 tubers for distribution.

Inoculating large seedling populations with late blight and eliminating susceptible plants prior to transplanting has proved successful for the past 2 years. It is planned to use this method to screen all progenies

segregating for resistance to late blight. Further work along this line will include additional strains of the fungus as well as parent material resistant to several strains of the late blight organism.

Recent work with seedling progenies segregating for X-immunity has indicated that an efficient method somewhat similar to that now being used for late blight can be developed for screening X-immune plants. When the method is a little more fully worked out it will be used for all progenies segregating for X-immunity. This will also provide a means for investigating more fully the inheritance of immunity to virus X.

Scab is prevalent in the muck soils where the first-year seedling hills are grown. Conditions are generally good for scab development, and most of the susceptible hills can be eliminated the first year in the field. Work is now under way on scab testing during growth of greenhouse seedlings using a method similar to that described by Dr. Dykstra in the 1950 report.

As far as testing for reaction to other diseases is concerned, it is proposed to delay extensive tests until selected clones have been increased and given at least some preliminary observations for adaptability.

Specific gravity tests for quality are made on material selected from observation plots of second-year and older selections. In our experience, selections made the second year from observation rows number about 0.2 percent of the original first-year, single-hill population. It is believed that a few of these selections probably would be eliminated for unsatisfactory cooking quality. Screening for cooking quality any earlier than the second year involves so many samples that the procedure does not seem to be economical.

So far as possible it is planned to test a number of selections for chipping quality. This quality is not a primary objective but information on this point might prove important in making final selections. Since it is relatively simple and inexpensive to test chipping quality, we hope to run a test on selections remaining after the second year. This will of course be done with the same samples used for specific gravity determinations.

Field plantings on muck soil at Clear Lake, Iowa, consist of three types of material: (1) First-year hills grown from greenhouse seedling tubers; (2) observation rows of selections and varieties; and (3) replicated yield trials that include selections from other States and the USDA, as well as Iowa selections and named varieties.

In order to maintain disease-free seed of material included in observation rows and yield trials, seed plots are grown at Northwood, North Dakota, in cooperation with Dr. W. G. Hoyman. The single-hill selections made at Clear Lake are divided and grown the following (second) year in an observation row at Clear Lake and in a seed-increase row at Northwood. Selections are made among the observation plots at Clear Lake, and samples from these are used for specific gravity, chipping, and disease-resistance tests. Only the clones selected at Clear Lake are saved from the Northwood plots. The Northwood material provides seed for testing and distribution. As a precaution against virus contamination of the Northwood plots, first-year hills selected at Clear Lake each fall are being indexed during the winter.

By this means we will plant in the seed plots nothing except indexed material from Clear Lake or seed lots from the Northwood plots the preceeding year.

The committee of potato breeders for the North-Central region has made detailed plans for a cooperative 6-State uniform-testing program. Under the proposed plan each of the 6 participating-States will distribute a maximum of 3 of their advanced selections for inclusion in adaptability trials in each State. A uniform field plan has been agreed upon, and a standardized system for taking notes and data will be used. In addition to the selections for adaptability trials, each State will distribute up to 10 selections for planting in observation plots. It is expected that this program will provide a great deal of information on the adaptability of selections from the different States. The data will be organized in such a way as to permit pooling and analysis as a single experiment replicated in 6 locations. Afew selections have been distributed for planting in 1951, and more are expected before planting time.

Results in 1950

Seed and Seedling Production

A good set of seed resulted from pollinations made in 1950. Crosses were confined mainly to those involving resistance to scab and late blight. Extensive use was also made of a few parents having immunity to virus X. Crosses involving resistance to other diseases, such as virus Y, leaf roll, and ring rot, were also made. Most of the parents were USDA and Iowa selections. Some early, scab-resistant selections provided by Dr. Krantz and some highly colored reds from Dr. Werner were also used. Thirteen crosses were made at the suggestion of Dr. John McLean. These involved parents that had shown some resistance to verticillium wilt in his tests.

Among the progenies observed in the field, those involving crosses with Min. 113.43-1-45, 6316, and Teton were outstanding in appearance and number of selections made. B962-32 also appears to be an excellent parent. We are fortunate to have sizeable remnants of several progenies that were outstanding this year.

Approximately 23,000 seedlings were grown in the greenhouse during the late summer and fall of 1950. All the progenies segregating for resistance to late blight were subjected to a screening test in the flats before transplanting. At least, 15,000 of the seedlings in the greenhouse crop can be expected to have resistance to the isolate of Phytophthora infestans used in this screening. There should be about 10,000 "B-size" tubers from the greenhouse crop available for distribution.

Distribution

Approximately 9,000 seedling tubers from the 1949 greenhouse crop were distributed for field planting in 1950. These were distributed to individuals in seven States who requested this type of material.

Advanced selections and named varieties grown by O. C. Turnquist in seed plots at Oklee, Minnesota, in 1949 were offered to cooperating States prior to the 1950 planting season. Of this type of material 224 lots were distributed to

potato workers in nine States.

First Year Seedlings

At Clear Lake 23,123 first-year hills were planted. In addition to seedling tubers from the greenhouse crop grown at Ames, 3,775 from Beltsville, and 1,014 from North Dakota were included in the Clear Lake planting. Because of heavy elimination for scab susceptibility and the necessity for limiting our material only about 1.0 percent of the seedling hills were selected for further testing.

Observation Plots

Observation plots at Clear Lake included 283, 5-hill observation rows grown from the 1949 single-hill selections, 123 advanced selections, and 48 named varieties. Iowa table 1 shows specific gravity, scab readings, and maturity

Iowa table 1. Specific gravity and scab readings for some of the potato varieties and selections grown in observation plots at Clear Lake, Iowa, 1950.

No.	Variety or Selection	Specific Gravity	Maturity	Scab type 1/
1	Parnassia	1.094	L	2
2	Ia. 8140-1	1.090	M	1
3	Ia. 820-1	1.090	E	2
4	B 962-32	1.088	M	1
5	Ia. 46-1-31	1.087	L	1
6	Mohawk	1.087	L	3
7	Red McClure	1.085	L	3
8	B 76-33	1.084	L	2
9	B 962-9	1.084	M	1
10	B 962-21	1.084	E	2
11	Pungo	1.083	L	2
12	Flava	1.083	L	2
13	B 776-2	1.083	L	3
14	Sequoia	1.081	L	3
15	Houma	1.081	L	3
16	Green Mountain	1.081	L	3
17	R. Burbank	1.081	L	1
18	B 780-27	1.081	L	2
19	Ia. 8169-8	1.081	L	1
20	Ia. 8169-1	1.080	L	1
21	Ia. 876-1	1.080	M	3
22	Cayuga	1.080	L	2
23	Seneca	1.079	L	2
24	Russet Rural	1.079	M	1
25	Yampa	1.079	L	1
26	Virgil	1.078	L	3
27	Erie	1.078	L	3

Iowa table 1 continued

No.	Variety or Selection	Specific Gravity	Maturity	Scab type 1/
28	Snowdrift	1.077	L	3
29	Cherokee (B61-3)	1.075	M	1
30	Sebago	1.075	L	2
31	Progress	1.075	M	3
32	Kennebec	1.074	L	3
33	Teton	1.074	L	3
34	Menominee	1.074	L	1
35	Katahdin	1.074	L	3
36	Kasota	1.074	M	3
37	6316	1.074	M	1
38	Saranac	1.073	L	2
39	Russet Sebago	1.073	L	2
40	Rural New Yorker	1.072	M	1
41	Ontario	1.072	L	1
42	Cobbler	1.072	E	3
43	Chenango	1.071	M	3
44	Pawnee	1.071	E	3
45	Pontiac	1.071	M	3
46	Mesaba	1.070	M	3
47	White Cloud	1.070	E	3
48	Golden	1.069	L	3
49	Red Pontiac	1.069	M	3
50	Marygold	1.069	L	3
51	Chippewa	1.067	E	3
52	White Rose	1.067	L	3
53	Earlaine	1.065	E	3
54	Satapa	1.065	E	3
55	Chisago	1.064	E	3
56	Triumph	1.064	M	3
57	Essex	1.063	M	3
58	LaSoda	1.063	M	3
59	B515-2	1.063	E	1
60	Canus	1.062	M	3
61	La Salle	1.062	M	2
62	Waseca	1.058	E	3

1/ Type

1 = Slight russet or surface scab.
2 = Raised or slightly pitted.
3 = Pitted scab.

for 62 of the varieties and selections included in the observation plots. Most of the material shown in table 1 was also included in a study of chipping quality. Data are being secured on color, yield of chips, oil obsorption, reducing sugar content, and response to conditioning after storage.

Yield Trials

Thirty selections and varieties were included in a replicated yield trial at Clear Lake. Results of this trial are presented in Iowa table 2. This was

Iowa table 2. Potato yield trial, Clear Lake, Iowa, 1950.

Rank	Variety or selection	Season	Scab 1/ Area type	Yield U.S. #1 tubers per acre		Specific 3/ gravity	Percent starch
				Bu. 2/	Pct.		
1	Yampa	L	1 - 1	733	93.3	1.079	13.6
2	Cherokee (B61-3)	M	T - 1	704	95.5	1.075	12.8
3	Wisc. 303-40	L	1 - 2	688	93.2	1.070	11.7
4	Wisc. M 804	L	1 - 1	642	93.3	1.077	13.2
5	Ia. 44-16-1	L	1 - 1	636	91.7	1.076	13.0
6	Kennebec	L	1 - 3	597	93.5	1.074	12.5
7	Ia. 45-12-4	M	1 - 2	583	92.2	1.070	11.7
8	Wisc. M 330	L	T - 1	576	94.5	1.083	14.5
9	Canus	L	2 - 3	560	85.1	1.067	11.1
10	Wisc. M 304	L	1 - 2	529	89.3	1.090	16.0
11	Ia. 46-1-31	M	T - 1	524	91.5	1.087	15.4
12	Min. 113.43-8-45	M	1 - 1	519	91.8	1.066	10.9
13.	B116-Ia. 13	L	T - 1	518	95.0	1.070	11.7
14.	6316	M	1 - 1	512	94.3	1.074	12.5
15	Sebago	L	1 - 3	501	93.9	1.075	12.8
16	X26-3	M	1 - 1	501	88.3	1.073	12.4
17	Progress	M	1 - 3	488	85.6	1.075	12.8
18	Neb. 225.43-1	E	2 - 3	471	83.9	1.075	12.8
19	Mich. R529-2	L	1 - 3	462	94.3	1.063	10.2
20	B515-2	E	T - 1	434	94.7	1.063	10.2
21	Wisc. M 439	M	1 - 1	431	94.3	1.080	13.9
22	White Cloud	E	2 - 3	430	78.1	1.077	13.2
23	Min. 24.43-6-45	E	2 - 3	429	85.7	1.070	11.7
24	Cobbler	E	2 - 3	415	82.8	1.069	11.5
25	Min. 24.43-5-45	M	2 - 3	413	83.9	1.072	12.1
26	Neb. 213-43-2	M	1 - 3	408	89.4	1.071	11.9
27	Ia. 46-22-4	E	1 - 2	367	82.9	1.067	11.1
28	Min. 35.43-6-45	E	1 - 3	351	88.5	1.071	11.9
29	Min. 113.43-1-45	E	T - 1	345	85.8	1.066	10.9
30	B596-7	M	1 - 1	302	92.0	1.070	11.7
Least Significant Difference	P = .05			81		.0049	1.0
	P = .01			107		.0065	1.3

1/ Area T = Trace
1 = Up to 20% of surface covered
2 = 21-40% " " "
3 = over 40% " " "

Type 1 = Surface or russet type
2 = Raised or slightly pitted
3 = Deep pitted scab

2/ Yield figures are mean yields in bushels per acre for 5 plots of 25 hills for each variety.

3/ Means of three 25-tuber samples.

---

an usually cool season in Iowa, and moisture supplies were ample. It appears that Yampa responds unusually well to such conditions. In the preceeding 2 years Yampa yielded significantly below Kennebec. Among the numbered selections included, Cherokee (B61-3) is worthy of special mention because it produced a high yield of scab-free tubers. Cherokee (B61-3), also has the important advantage of resistance to late blight. It has a tendency toward irregular-shaped tubers, and in a few locations it has produced some second growths. However, it appears to be well adapted to muck soils and should be useful on such soils where scab is serious.

Another selection worthy of special attention is 6316. It produces uniform tubers of excellent type, which are very smooth and free from severe scab. It has never produced outstanding yields but because of its high percentage of uniform U.S. #1 potatoes it has looked promising for several years. In the 1950 trials it has made its best showing to date.

Becuase of the interest in potatoes for farm and home gardens in Iowa a small test was planted at Ames. Since insect and disease control is often neglected in farm and home garden plantings, this test also served to demonstrate what can be accomplished with proper insect control. No fungicide treatment was used. DDT dust was applied five times during the growing season. Data on the performance of eight varieties and selections grown at Ames are presented in Iowa table 3.

Iowa table 3. Potato yield trial Ames, Iowa, 1950

Variety	Season	Yield U.S. #1 tubers per acre		Specific gravity 2/	Notes
		Bu. 1/	Pct.		
Kennebec	L	652	94	1.085	Oversize tubers, earlier than Sebago & Katahdin
Katahdin	L	550	95	1.082	
Sebago	L	532	92	1.085	
Cherokee (B61-3)	M	468	89	1.085	Very irregular and rough
R. Warba	E	419	84		
Waseca	E	415	91		Best of early varieties
Cobbler	E	411	83		
Min. 23	E	355	89		Severe growth-cracks rough
Least Significant Differences	P = .05	71			
	P = .01	97			

1/ Means of 5 replications of 20 hills.
2/ Means of 3 25-tuber samples.

In the heavy soil at Ames, Cherokee (B61-3) produced extremely rough tubers. Waseca looked much better than the other early varieties. Among the late varieties, Kennebec appears promising because of its high yield. The late blight resistance of Kennebec would also be a great advantage on the rare occasions when this disease is a problem in home and farm garden plantings.

Resistance to Phytophthora infestans

Resistance to the late blight fungus, Phytophthora infestans, is manifest in the seedling stage following spray inoculation of the foliage with a heavy suspension of sporangia. In progenies segregating for resistance, seedlings were inoculated before transplanting and only the resistant survivors used for further propagation. The relative efficiency of the seedling inoculation was determined by comparing the percentage of susceptible segregates from a progeny which had not been subjected to seedling inoculation with the percentage of susceptible segregates surviving inoculation in the seedling stage. In this test, seedlings of 12 progenies were subjected to late blight inoculation. The healthy survivors were propagated in the greenhouse, and one tuber of each seedling plant was further increased in the field. An unscreened population was treated in a similar manner (Iowa table 4).

Iowa table 4. The number of blight-resistant segregates in populations which had been inoculated with Phytophthora infestans in the seedling stage compared with those from uninoculated populations.

Pedigree number	Parents	Uninoculated population		Survivors of an inoculation test	
		Res.	Sus.	Res.	Sus.
		No.	No.	No.	No.
I 801	B 595-76 x B 67-11	38	9	21	1
I 802	" x Cherokee (B61-3)	27	7	16	0
I 901	" x Min. 59.44	10	20	7	0
I 902	" x Min. 113.43	17	17	17	0
I 903	" x B 754-9	19	14	13	0
I 904	" x B 874-25	20	15	5	4
I 907	B 595-187 x Min. 59.44	10	15	7	0
I 909	" x Min. 113.43-1	31	44	28	0
I 934	B 754-9 x Cherokee (B61-3)	29	56	17	0
I 935	" x B 67-11	46	47	13	0
I 952	B 899-3 x Cherokee (B61-3)	4	6	10	2
I 953	" x B 96-56	9	6	10	1
Total		260	256	164	8
Percent		50.4	49.6	95.4	4.6

One tuber from each hill was exposed to infection in the greenhouse using the same isolate of P. infestans as was used in the early inoculation. In this case, an isolate obtained from naturally infested Cobblers in Iowa was used. In the uninoculated population, approximately 50 percent of the plants were susceptible to late blight, whereas following the seedling inoculation, less than 5 percent

of the survivors were shown to be escapes. Although approximately 50 percent of the uninoculated population were susceptible to blight, certain progenies, I-801 and I-802, had a higher percentage of resistant segregates than did others. Although a small number of escapes were present following seedling inoculation, it was concluded that the method was very satisfactory for use in a breeding program.

Identification of Segregates Resistant to the Latent (X) Virus of Potatoes

A method of screening populations of seedling potatoes segregating for immunity to the X virus is being developed. Seedling plants were inoculated in the seedling flat when about an inch high, using a modification of the method of Richards and Munger (Phytopathology 34: 1010. 1944). The plants were sprayed with the expressed juice of Nicotiana glutinosa plants infected with virulent ring spot strain of virus X supplied by Dr. R. H. Larson of the Wisconsin Agr. Expt. Sta. Segregating progenies were obtained by crossing susceptible parents with X-immune types, such as X41956 or parents derived from X41956. Under optimum conditions for symptom expression approximately 50 percent of the population was susceptible to the strain of the X-virus used in the inoculation.

Further work is under way to establish the efficiency of this test.

Y Virus

Resistance studies were continued on 18 of the 216 selections and varieties reported from North Dakota in 1949.

Of the varieties and selections tested only two appear to have a great deal of resistance. In the selection B 738-8 only 1 plant out of 10 became infected when growing adjacent to a Y virus carrier and mechanically inoculated with expressed juice from this carrier.

The variety Snowdrift did not become infected during 1949 or 1950 under field conditions when growing adjacent to ND 530 (a Y-virus carrier), or when mechanically inoculated with expressed sap. However, grafts made at Ames in 1950 using ND 530 as a scion caused two out of four Snowdrift plants to develop systemic necrosis. The tubers from these plants are at the present time being tested for presence of the Y virus.

Vine Killing

Most of the cultural experiments carried on for the past few years are being discontinued in order to devote more time to the breeding work. Vine-killing experiments started in 1949 were repeated in 1950. This year provided conditions greatly different from those of 1949, and the results, particularly with regard to internal tuber discoloration, were quite different. In 1949 considerable discoloration resulted from some of the vine-killing treatments, whereas in 1950 there was very little discoloration due to vine killing. Iowa tables 5 and 6 show the effect of vine-killing treatments on yield and starch content of four varieties. It will be noted that for the late varieties vine killing in early September caused an important reduction in yield compared with the check plots which were killed by frost on September 23. These data seem to

emphasize the need for varieties that will either mature their maximum crop early or set early and develop a heavy yield before the normal occurrence of frost. The yield of Kennebec was approaching that of Cobbler by September 2. Iowa table 5 shows that vine killing or frost on that date would have resulted in loss of more than 100 bushels per acre for Kennebec while Cobbler would have suffered practically no loss in yield.

Iowa table 5. Effect of some vine-killing treatments on yields.[1/]

Varieties	Check [2/]	2,4-D [3/] 7/20	Chemical kill [4/]		Mechanical kill [5/]		Variety means
			8/21	9/2	8/21	9/2	
Cobbler	499	425	456	515	434	494	470
Kennebec	588	599	397	417	317	454	463
Yampa	576	539	396	493	396	497	483
Sebago	448	500	365	371	282	328	382
Treatment means	528	516	404	449	357	443	

Least significant differences:	P = 0.05	P = 0.01
Between treatment means	64 bu.	89 bu.
Between variety means	29	38
Between treatment means in same variety	71	94
Between variety means within treatments	86	114

Iowa table 6. Effect of vine killing on starch content of tubers.

Varieties	Check [2/]	2,4-D [3/] 7/20	Chemical kill [4/]		Mechanical kill [5/]		Variety means
			8/21	9/2	8/21	9/2	
	%	%	%	%	%	%	%
Cobbler	12.6	12.1	11.6	12.4	11.9	12.1	12.1
Kennebec	13.5	13.5	11.5	12.4	10.9	12.1	12.4
Yampa	13.4	13.2	12.0	12.9	11.8	12.6	12.7
Sebago	12.6	12.8	11.1	11.5	9.8	10.2	11.5
Treatment means	13.0	12.9	11.5	12.3	11.1	11.9	

Least significant differences:	P = 0.05	P = 0.01
Between treatments within variety	0.6	0.8
" variety means in same treatment	.7	.9

1/ Yields are bushels per acre, means of 4 plots - 1 row x 25 hills.
2/ Check plots were killed by frost on September 23.
3/ 2 pounds per acre of sodium salt of 2,4-D.
4/ Chemical treatment: 2 pints of Sinox general plus 2 gallons of diesel fuel per 100 gallons water, applied at approximately 100 gallons per acre.
5/ Mechanical treatment: All stems were cut about 4 inches from ground.

KANSAS

Claude L. King and Gwendolyn L. Tinklin

A number of potato varieties were tested for yield in Shawnee County in comparison with Irish Cobbler. Kansas table 1 gives the data for this test.

Kansas table 1. Yield data and notes for a number of potato varieties grown in comparison with Irish Cobbler in Shawnee County in 1950

Variety	Yield per acre	Notes
	Bu.	
Irish Cobbler	379	Some scab; tubers skinned when washed.
La Salle	425	Scabby, very large tubers; didn't wash clean.
White Cloud	438	Scabby, tubers didn't skin like Irish Cobbler when washed.
White Cloud	388	Do
Progress	305	Small red tubers, scabby.
B-69-16	251 370	Tubers flatter than those of White Cloud; some scab, shallow eyes, clear skin, green vines. Tubers didn't skin like Irish Cobbler when washed.
B76-43	387	Scabby; green vines.
B355-44	285	Some scab, smooth; vines green.
B637-14	257	Scabby.

The data are not too conclusive, but some of the varieties were superior to the Irish Cobbler. The varieties Irish Cobbler, B69-16, White Cloud and La Salle were cooked by the following methods: Creaming, mashing, boiling, baking, and French frying. The data for these tests are given in Kansas table 2.

Kansas table 2. Tests of four varieties of potatoes cooked by creaming, mashing, boiling, baking, and French frying. The data show the rank of each variety for each method of cooking.

Cooking method	Rank			
	Irish Cobbler	B69-16	White Cloud	La Salle
Creamed	1	2	4	3
Mashed	4	2	1	3
Boiled	4	2	1	3
Baked in foil	3	4	2	1
Baked plain	3	4	1	2
French fried	4	3	1	2

None of the potatoes baked too well. This may have been due to inmaturity. White Cloud and La Salle were both superior to Cobbler when baked. The judges objected to the flavor of B69-16 when baked but not when cooked by any other method. Irish Cobbler was preferred for creaming but the other three varieties were superior to Cobbler when mashed, boiled, or French fried. White Cloud was first choice of the judges when the potatoes were mashed, plain boiled, French fried or plain baked. With all methods of cooking all varieties were equal to the Cobbler. Any of the four varieties could be used with fair satisfaction. B69-16 resembled the waxy type of potato, whereas the other three varieties had more characteristics of the mealy type.

MAINE

R. Bonde

Project: Adams 18. Breeding potatoes resistant to bacterial ring rot.

Project leaders: Reiner Bonde, F. J. Stevenson, and Robert Akeley.

Importance of the Problem: The control of ring rot is a very important problem in almost all of the potato-producing areas of America. There is evidence that the disease also is becoming an important problem in certain European and South American countries. The loss to the potato crop of Aroostook County, Maine, is estimated to be $500,000 to $600,000 annually.

The disease causes an active decay and reduces the quality of table-stock potatoes. Seed potatoes do not qualify for certification if they contain even a trace of ring rot.

Objects: To discover sources of natural resistance to bacterial ring rot which can be used in the breeding program for the development of resistant varieties of potatoes.

Test for ring rot resistance large numbers of selected seedlings from resistant parents with the aim of selecting desirable commercial varieties of potatoes that are resistant to or immune from the disease.

Test for ring rot resistance unselected progenies of known parents for the purpose of learning more about the inheritance of the disease.

Plan of Work: Potato seedlings are grown from true seed in the greenhouse at Beltsville, Md., and shipped to Presque Isle, Maine. They are planted on the Chapman Farm where those with desirable plant and tuber characters are selected for further study. The seedlings from ring rot resistant parents are inoculated with ring rot bacteria prior to being planted. Those that survive these inoculations for 3 successive years are increased for further study regarding their disease resistance, marketing qualities, and ability to yield. Some of the desirable seedlings are used as parents in the breeding program.

Location: Presque Isle, Maine (Aroostook Farm).

Results to Date: Varieties that are resistant to ring rot were not known when the project was begun in 1940. Since then resistant parents have been found which were used in the breeding program.

The first resistant seedlings that were produced possessed undesirable marketing qualities and plant characters. They were very late and produced mostly poorly shaped tubers. The breeding stocks used in this project have been improved until now the progenies have a fairly high percentage of promising seedling varieties with good tuber shape and plant characters.

A number of desirable parents have been found and it now seems that resistant varieties with good marketing qualities can be produced. It appears only necessary to make the desired crosses and select from the progenies the varieties that have the necessary qualities.

Progress also has been made in combining ring rot resistance with resistance to late blight, and some promising seedlings with resistance to both diseases have been developed.

MAINE

Reiner Bonde and Donald Merriam

Testing new potato seedlings for ring-rot resistance and for superior marketing quality was continued in 1950. About 445 selected seedlings from different progenies were tested for ring-rot resistance. Bonde table 1 summarizes the results of this study. The test yielded 111

Bonde table 1. Ring-rot-resistant seedlings in different progenies inoculated in the field in 1949.
Ring-rot controls included for comparison 1/

Variety or cross	U.S.D.A. pedigree	Seedlings tested	Resistant seedlings or lots 2/		Seedlings saved for further use 3/
			No.	Pct.	
Katahdin controls 4/	(88 lots or 440 plants)		0	0.0	0
B76-23 x B445-41	B2335	27	5	18.5	4
B606-37 x B607-56	B2390	19	7	36.8	5
B607-56 x B355-44	B2391	14	11	78.5	8
B607-56 x B402-1	B2392	10	4	40.0	4
B607-72 x B606-3	B2395	26	16	61.5	15
B607-72 x B607-56	B2396	21	19	90.4	16
Kennebec x B445-41	B2399	14	3	21.4	1
B608-56 x B445-41	B2402	4	2	50.0	2
B478-1 x B607-56	B2425	44	17	38.5	15
Chippewa x B445-41	B2431	129	30	23.2	20
B607-72 x B778-14	B2434	31	10	32.1	3
B778-14 x B61-3	B2435	9	1	11.1	1
B778-14 x B607-56	B2437	13	10	76.9	8
B446-54 x B76-23	B2574	19	4	21.0	4
B580-20 x B445-41	B2583	9	0	.0	0
B594-46 x B445-41	B2586	11	0	.0	0
B607-55 x B61-3	B2587	1	1	100.0	1
B607-56 selfed	B1235	10	6	60.0	4

1/ Five freshly cut seed pieces of each seedling were inoculated by being dipped in a heavy suspension of the bacteria and planted immediately in the field.

2/ Showed none or only a trace of ring rot when harvested.

3/ Seedlings saved for further use because of desirable tuber type and plant characteristics combined with ring rot resistance.

4/ Of 440 plants inoculated, 415 developed ring-rot symptoms or 94.3 percent.

seedlings which possessed ring-rot resistance, freedom of virus disease, and desirable marketing qualities as judged by tuber shape and plant characters. It is of special interest that none of the resistant seedlings were exceedingly late-maturing or possessed ill-shaped tubers, as was the case when these studies were begun.

The reaction of 2 named varieties and 13 seedlings used as parents for these experiments are given in Bonde table 2. Seedling B355-44, B607-56,

Bonde table 2. Ring rot in parents of seedlings of different progenies inoculated in field in 1950.

Variety or seedling	Inoculated 1/	Without ring rot 2/	
	No.	No.	Pct.
Katahdin controls	15	0	0
B61-3	5	0	0
B76-23	5	1	20
B355-44 3/	10	10	100
B355-24	5	3	60
B402-1	5	2	40
B445-41 3/	5	0	0
B446-54	5	3	60
B515-2	5	2	40
B603-3	5	5	0
B607-55	5	4	Trace
B607-56	5	5	100
B607-72	5	5	100
B608-56 3/	30	20	66
Chippewa	5	0	0
Kennebec	5	0	0

1/ Innoculated by dipping freshly cut seed pieces in heavy suspension of ring-rot bacteria. Seed pieces planted immediately after inoculation.

2/ Showed no ring-rot symptoms when examined at time of harvest.

3/ Inoculations made in 1947 and 1948.

and B607-72 are very resistant parents and have failed to show symptoms of ring rot when inoculated. Seedlings B355-24 and B607-55 developed some infection in 1950 and apparently are less resistant than the above-named parents.

Bonde table 3 gives the reaction of the different progenies and parents to ring rot according to five classes of infection. The data confirm our previously secured information that the progeny of certain crosses yield relatively high percentages of resistant seedlings. Most of these resistant

seedlings possessed good tuber shape and fairly early maturity.

Bonde table 3. Reaction to ring-rot infection of Katahdin controls of parents of crosses and their progenies.
Aroostook Farm -- 1950

Variety or cross	U.S.D.A. pedigree	Seedlings tested 1/	Classes of infection 2/						Total showing infection
			0	1	2	3	4	5	
		No.	%	%	%	%	%	%	%
Parents									
Katahdin controls			0	0	2	3	19	76	100
B61-3								100	100
Kennebec								100	100
B76-23							80		80
B402-1						60			60
B355-24				40					40
B446-54				40					40
B515-2						60			60
B606-3								100	100
B607-72			100						0
Progenies									
B76-23 x B445-41	B2385	27	15	4	15	7	4	57	87
B606-37 x B607-56	B2390	19	26	10	16	21	10	16	73
B607-56 x B355-44	B2391	14	57	21	7	0	0	14	42
B607-56 x B402-1	B2392	10	40	0	0	0	0	60	60
B607-72 x B606-3	B2395	26	60	4	15	11	0	11	41
B607-72 x B607-56	B2396	21	76	14	5	0	0	5	24
Kennebec x B445-41	B2399	14	7	14	14	14	7	44	93
B608-56 x B445-41	B2402	4	50	0	0	0	0	50	50
B473-1 x B607-56	B2425	44	34	5	9	11	5	36	66
Chippewa x B445-41	B2431	129	15	8	5	8	9	55	85
B607-72 x B778-14	B2434	31	10	23	16	13	6	32	90
B778-14 x B61-3	B2435	9	0	11	0	11	11	67	100
B778-14 x B607-56	B2437	13	15	39	15	8	0	23	85
B446-54 x B76-23	B2574	19	21	0	21	10	5	43	79
B580-20 x B445-41	B2583	9	0	0	33	33	0	33	100
B594-46 x B445-41	B2586	11	0	0	18	18	9	55	100
B607-55 x B61-3	B2587	1	1	0	0	0	0	0	0
B607-56 selfed	B1235	10	40	20	20	10	0	10	60

1/ Five freshly cut seed pieces of each variety or lot inoculated by being dipped in a heavy suspension of the bacteria and planted immediately in the field. With the Katahdin controls 90 lots of tubers each were inoculated.

2/ Classes of infection:

0 = No plants infected
1 = 1 " "
2 = 2 " "
3 = 3 plants infected
4 = 4 " "
5 = 5 " "

About 2,000 seedlings from unselected progenies grown at the Plant Industry Station at Beltsville, Md., were tested for their reaction to ring rot, and 83 were selected because of their resistance to ring rot combined with desirable plant and tuber characteristics. These will be tested again in 1951. Tests conducted in previous years have shown that 1 to 2 percent of the seedlings selected as being resistant contract the disease when reinoculated the following year.

Our greatest loss in the selected seedlings comes from field contamination of leaf roll and the A, X, and Y mosaic diseases. Also, many ring-rot-resistant seedlings are discarded because of poor foliage characters or too late maturity.

Approximately 1,211 unselected seedlings from progenies of 7 crosses were inoculated with ring-rot bacteria to learn more about the inheritance of resistance to this disease. The results of this experiment are summarized in Bonde table 4. Of special interest is the fact that no infection was

Bonde table 4. Percentage ring-rot-resistant seedlings in progenies from crosses using parents with different degrees of susceptibility. Aroostook Farm - 1950

Parentage	Pedigree No.	Degree resistance in parents used in crosses	Seedlings inoculated 1/ Total	Resistant 2/		Infection in inoculated controls
			No.	No.	Pct.	Pct.
B355-24 selfed	B1271	High selfed	92	5	5.4	100
B355-44 selfed	B1272	High selfed	169	6	3.5	100
B355-24 x Flava	B2836	High x unknown	184	184	100	90
Furore sport x Teton	B2843	High x high	25	4	16.0	90
Furore x B607-72	B2844	High x high	395	38	9.6	94
Furore x B721-30	B2845	High x unknown	158	16	10.0	100
B606-3 x Furore	B2851	Susceptible x high	188	18	9.5	100

1/ Inoculated by dipping bruised and cut tubers in heavy suspension of the ring-rot bacteria. Tubers planted immediately after inoculation.

2/ Showed no ring rot during growing season or at harvesttime.

noted in the progeny of B355-24 x Flava. Flava, a German variety, has not been tested for ring-rot resistance in Maine, but apparently has genetic factors for ring-rot resistance and makes a good parent. Furore, another foreign variety, was a good parent and produced some promising resistant seedlings.

Reaction of Certain Ring-Rot-Resistant Seedlings to Late Blight infection on Foliage and in Tubers

The aim of the potato-breeding program is to develop seedlings that have desirable marketing qualities and also resistant to the different pests and diseases.

It would be very desirable if the new seedlings that are introduced for commercial production were resistant to one or more of the serious diseases and pests. Some of the seedlings found to be highly resistant to ring rot in Maine have parents that are resistant to late blight. During 1950 an experiment was conducted for the purpose of determining whether certain of these ring-rot-resistant seedlings also are resistant to late blight.

Fifteen ring-rot-resistant seedlings and 5 control varieties or seedlings were planted in the field in 3 replicated 10-hill plots. The plants received no fungicidal spray treatments and were planted in a low wet area, which is very conducive to late blight infection both in the plants and the tubers.

Foliage resistance: The late blight disease appeared early in August and spread very rapidly in the susceptible varieties. The data in Bonde table 5 show

Bonde table 5. Reaction of certain ring-rot-resistant seedlings to late-blight infection in foliage and tubers Aroostook Farm - 1950.

Variety or pedigree No.	Parentage	Reaction to late blight		
		Foliage infection 1/	Tuber infection	
			Artificial inoculation 2/	Natural 3/
		Pct.	Pct.	Pct.
B721-35	Earlaine x Teton	96.0	88.2	45.0
B724-7	Sequoia x Teton	.0	.0	.0
B725-1	B336-184 x Teton	20.0	64.2	48.0
B725-3	B336-184 x Teton	Trace	.0	.0
B762-50	B96-44 x Teton	35.0	42.8	18.0
B911-7	055 x Teton	94.0	45.4	47.0
B911-23	055 x Teton	90.0	68.1	50.0
B911-37	055 x Teton	95.0	86.6	48.0
B913-2	055 x B355-24	20.0	30.7	25.0
B915-3	B231-3 x B355-24	Trace	100.0 4/	.0
B916-16	Gr.Mountain x B231-3	.0	.0	.0
B919-2	B355-24 x (X792-94)	40.0	81.8	22.0
B919-8	B355-24 x (X792-94)	40.0	64.2	25.0
B355-24	96-56 x 336-144	.0	.0	.0
B355-44	96-56 x 336-144	.0	.0	.0
Kennebec		.0	8.4 4/	.0
Sebago	Chippewa x Katahdin	35.0	61.9 4/	.0
Gr. Mountain	Dunmore x Excelsior	95.0	68.5	50.0
Katahdin	40568 x 24642	95.0	83.3	60.0

1/ Approximate degree of infection September 10, 1950.
2/ Freshly dug tubers inoculated by being sprayed with a suspension of spores and then placed in storage under moist conditions.
3/ Approximate infection from natural infection at harvesttime.
4/ Infection occurred mostly through skin bruses and abrasions.

that seedlings B721-35, B911-7, B911-23, B911-37, and the control varieties Green Mountain and Katahdin were 94 to 96 percent defoliated before September 1. Seedlings B724-7, B725-3, B915-3, B916-16, B355-24, B355-44, and Kennebec were very resistant and showed none or only a trace of apparent late blight infection in the foliage.

Sebago and a number of seedlings with late-blight resistant parents showed considerable foliage resistance in the field and were 20 to 40 percent defoliated by the disease.

Tuber resistance -- artificial inoculation. Resistance of the tubers of the different seedlings to late blight infection was also tested in 1950. Ten to fifteen freshly dug tubers of each variety included in the experiment were inoculated by being sprayed with a suspension of the spores of the fungus and then placed in storage under moist conditions. The tubers were examined for late-blight rot after about 4 weeks. The results of this test are summarized in Bonde table 5 column 4. It can be noted from the data that the tubers of 5 of the seedlings were not infected as a result of the inoculations. The seedling selections that did not develop late-blight rot are B724-7, B725-3, B916-16, B355-24, and B355-44. It is of interest that 2 of the selections with a trace of foliage infection failed to develop decay in the tubers.

Tuber resistance -- natural infection. The test plot was located on dark Washburn loam soil which favors the development of rot during wet rainy seasons. Bonde table 5, column 5 gives the percentage of rot that developed under natural field conditions. It can be noted from the data that six of the seedlings and the Kennebec and Sebago varieties failed to develop late-blight rot in the field.

Of special interest is the fact that the varieties B915-3, Sebago, and Kennebec which developed rot when inoculated did not become infected under natural field conditions. This was because the inoculated tubers became infected through the stolon or skin wounds that were produced while the green tubers were being dug. Experiments have shown that many resistant varieties may become infected with late blight if the periderm of the tubers is broken.

Late Blight Infection in Inoculated Tubers of Certain Selected Ring-Rot Resistant Seedling Varieties

During 1950 approximately 59 selected ring-rot-resistant seedling varieties were tested for tuber resistance to late-blight infection. Tubers of the varieties were carefully dug by hand to avoid bruising and inoculated immediately by spraying with a suspension of late-blight conidia. The inoculated tubers were placed in storage under moist conditions for 4 weeks before being examined for the presence of late-blight decay.

The tubers of 14 of the inoculated seedlings failed to become infected with late-blight fungus and can be considered to be very resistant to this rot. The tubers of 5 other varieties developed relatively little rot and probably would be very resistant under natural field conditions. It should be recalled that the tubers of the Sebago and Kennebec, which are very resistant to rot in the field, developed some decay when bruised and inoculated with late-

blight spores under favorable conditions (see table 5). It also is very probable that a number of other seedlings that showed rot in this experiment are actually very resistant under natural field conditions and when the periderm of the tubers is not broken prior to being dug and contaminated with the late-blight spores.

Reaction to Late Blight Infection of Certain Seedling Varieties Selected for Resistance to Leafroll

Twenty seedlings selected as being resistant to leaf roll were tested for resistance to late blight tuber rot. The freshly-dug tubers of the different varieties were inoculated by being sprayed with a suspension of the conidia and placed in moist storage for 4 weeks.

None of the leaf roll resistant varieties was also resistant to late blight.

MAINE

Donald Folsom and Donald Merriam

Yield Test of Leaf Roll Resistant Seedlings at Aroostook Farm 1950

In 1949, 24 seedlings grown at Highmoor Farm and 15 grown at Aroostook Farm, only one being in both lists, made up 38 that were considered worth testing for yield. Others had been tested sufficiently, were not promising, or had not yet been grown long enough to furnish enough seed for a yield test or to see how promising they might be. The 38 seedlings were tested for yield rate on Aroostook Farm in 1950. One to 10 plots were planted with any seedling. The seedling plots were interspersed with 44 plots of each of the 3 standard varieties, Chippewa, Green Mountain, and Katahdin. The yields were examined for tuber type and size. Allowance was made for field variation as indicated by the plots of the standard varieties.

Chippewa, Katahdin, and Green Mountain yielded respectively 556 ± 15, 588 ± 8, and 652 ± 7 bushels an acre with tubers averaging 3.85, 4.66 and 6.23 ounces. Within plots of each standard variety, there was a general correlation between yield rate and average tuber weight. Tuber shape was much more uniform in the Chippewa and Katahdin than in the Green Mountain.

The highest yielding seedlings, with 569 and 613 bushels an acre, had undesirable tuber shape. No other seedling yielded more than 513 bushels an acre. The low yield rates, together with the rarity of leaf roll resistance and the poor cooking quality of many resistant seedlings (see Folsom's section of this report), confirm the impression that for a long time to come, leaf roll control will be dependent upon measures other than resistance.

MAINE

Donald Folsom

Leaf Roll Resistance, 1950, at Highmoor Farm

As indicated in the report for 1949, the field test on Highmoor Farm, with every third row leaf roll Chippewa, was more severe than usual in 1948, so that in 1949 leaf roll appeared in a hitherto field-immune seedling (B24-58) and in about 25 percent of the aphid-tested seedlings. With aphid counts unusually low in 1949, seedling B24-58 contracted no leaf roll, although Chippewa, Green Mountain, and Katahdin contracted about as much as in 1948. The percentages for these commercial varieties were respectively 96 and 88, 90 and 95, and 50 and 53 for the 2 years. Seedling 1276-185, grown commercially to some extent in Maine, contracted 37 percent leaf roll in 1948 and 3 percent in 1949. Placid contracted 57 percent, and Kennebec 100 percent, in 1949.

A brief history of the 1,531 seedlings introduced to the Highmoor test from Beltsville in 1948 is given in Folsom table 1.

Folsom table 1. Beltsville seedlings introduced to Highmoor Farm 1948.

Crosses	Seedlings grown 1948	Seedlings grown 1949			Seedlings grown 1950			
		Total	Leaf roll		Total	Leaf roll		Kept for 1951
	No.	No.	No.	Pct.	No.	No.	Pct.	No.
B2155, B2165, B2168; with B522-33 1/ as one parent	717	411	376	91	28	8	29	9
B2184, B2185, B2186; with X1276-185 2/ as one parent	636	269	219	81	27	16	59	0
B2187 (X1276-185 x B522-33)	178	130	94	72	24	6	25	8

1/ Resistant to leaf roll in Aroostook Farm aphid test.
2/ Field-resistant to leafroll in tests at Highmoor Farm and elsewhere.

Nearly half of them were discarded in 1948 because of poor vine growth, low yield, poor tuber type, or excessive smallness of tubers (though numerous). The ones kept showed less leaf roll in 1949 and 1950 if both parents were leaf roll-resistant seedlings than if only one parent was a leaf roll resistant seedling. However, the percentage with leaf roll was so high, and eliminating defects were so common, only 17 are now left for further testing in 1951.

Of seedlings introduced to the Highmoor Farm test plots in 1947, 1948, 1949, and 1950 from the aphid-inoculation test at Aroostook Farm, 11 remain for further observation in 1951.

Because of the unusual spread of leaf roll in this test in 1948, somewhat more tolerance was allowed in 1949 than previously. Similar tolarance was allowed in 1950 in some seedlings because of the scarcity of seedlings with generally good characteristics. This allowed some comparison between plantings by 4-hill units, 2-hill units, and uncut tubers in a number of seedlings, with respect to leaf roll percentage. The results are given in Folsom table 2. In 9 out of 14 instances, the percentage of leaf roll was

Folsom table 2. Percentages of leaf roll in different tuber-size classes of seedlings with varying degrees of field resistance to leaf roll. Highmoor Farm, 1950.

Seedling	Leaf roll			
	4-hill tuber units	2-hill tuber units	Hills from uncut tubers	All hills
	Pct.	Pct.	Pct.	Pct.
B24-78	40	0	--	20
B226-135	100	0	--	67
B514-14	39	15	10	14
B579-195	65	50	38	50
B751-22	--	24	12	19
B751-119	0	7	0	3
B751-193	47	23	25	31
B789-28	50	24	9	23
B789-388	--	35	27	31
B789-487	88	10	--	41
B583-67	47	3	0	6
B853-8	15	30	9	21
B853-31	43	55	78	59
B853-91	80	85	98	86
B859-10	30	16	--	22
B859-25	14	35	--	26

higher in 4-hill tuber units (planted from tubers of about 6 ounces and larger) than in 2-hill tuber units (planted from tubers of about 3 to 6 ounces). In 8 out of 11 instances, the percentage of leafroll was higher in 2-hill tuber units than in hills planted with uncut tubers (2 to 3 ounces).

Tubers of 20 seedlings were compared with Chippewa, Katahdin, and Green Mountain tubers when boiled, as to color, texture, and flavor. Thirteen were yellower and one was darker, in the cooked flesh, than the standard varieties. The only seedling superior to Katahdin was inferior to Green Mountain and yielded low in the Aroostook Farm yield test (see Folsom-Merriam section of this report), while two seedlings that were about as good as Katahdin yielded fairly well. The others were not as good as Katahdin.

MAINE

W. C. Libby and Robert V. Akeley

In 1950 the cooperative yield tests were conducted at Van Buren, Presque Isle, Sherman Mills, Lee, Dover-Foxcroft, and Exeter. The objective of these trials is to test the more promising seedling varieties in comparison with standards in a number of places in Maine.

Maine (Libby) table 1 presents the data for yield and specific gravity of 16 varieties grown in 6 locations. Essex ranked first for an average for all 6 stations, Ontario second, Kennebec third, and Green Mountain fourth. B 73-10, a seedling that is being considered for release in some of the Southern States yielded in the same class as Green Mountain. It has the same high degree of resistance to late blight as Kennebec and showed some resistance to scab in tests at Charleston, S. C. Pungo, a blight-resistant variety recently released in cooperation with the Virginia Station, was in the same rank as Green Mountain in yield but outyielded the Irish Cobbler, with which it has to compete in Virginia, by 141 bushels per acre. It has outyielded the Cobbler in a number of trials in Virginia, especially under droughty conditions. B 61-3, recently named Cherokee and released in cooperation with the Iowa and Indiana Stations, is resistant to both late blight and scab. The average yield of this variety for the 6 locations was 626 bushels per acre. It outyielded the Irish Cobbler, the variety with which it has to compete in the Middle West, by 73 bushels per acre. B 355-44 is resistant to late blight and ring rot. It yielded about the same as Irish Cobbler.

The specific gravity readings for all varieties were comparatively low. Mohawk was the highest, but not significantly higher than Green Mountain. Both of these varieties were significantly higher than Kennebec, but it is doubtful if the difference between 1.077 and 1.072 could be detected in an actual cooking test.

Maine (Libby) table 1. Cooperative yield trials, Maine, 1950. Comparison of yields and specific gravity of 16 potato varieties and seedlings grown at 6 locations in Maine.

Variety or Seedling	Presque Isle		Dover Foxcroft		Lee		Sherman Mills		Van Buren		Exeter		Yield average 1950	1947-50 average yield	1950 average specific gravity	1947-50 average specific
	Yield per acre	Specific gravity	Yield per acre	Specific gravity	Yield per acre	Specific gravity	Yield per acre	Specific gravity	Yield per acre	Specific gravity	Yield per acre	Specific gravity				
	Bu.		Bu.		Bu.		Bu.		Bu.		Bu.		Bu.	Bu.		
Essex	748	1.067	698	1.065	832	1.068	924	1.062	661	1.063	963	1.064	804	---	1.065	-----
Ontario	809	1.073	762	1.066	791	1.070	768	1.062	599	1.063	941	1.065	778	674	1.067	1.067
Kennebec	795	1.076	677	1.082	685	1.073	827	1.065	681	1.069	774	1.067	740	667	1.072	1.072
Gr. Mt.	746	1.084	676	1.076	686	1.082	690	1.073	689	1.073	832	1.071	720	640	1.076	1.077
B 73-10	783	1.071	605	1.070	651	1.076	743	1.062	651	1.068	735	1.067	697	---	1.069	-----
Pungo (B 76-43)	721	1.074	581	1.075	620	1.076	835	1.065	654	1.073	753	1.070	694	647	1.072	1.076
Teton	677	1.070	619	1.071	635	1.071	749	1.062	608	1.069	838	1.064	688	616	1.068	1.069
B 637-14	624	1.067	607	1.064	677	1.067	645	1.057	607	1.063	776	1.064	656	---	1.064	-----
Cherokee (B61-3)	646	1.075	549	1.074	608	1.078	709	1.064	587	1.072	655	1.067	626	---	1.072	-----
Mohawk	605	1.087	572	1.079	668	1.084	685	1.071	517	1.069	667	1.070	619	522	1.077	1.077
B 447-98	627	1.071	526	1.070	547	1.076	648	1.065	619	1.066	623	1.066	598	---	1.069	-----
Erie	651	1.074	581	1.070	513	1.0689	590	1.060	494	1.067	706	1.066	589	---	1.068	-----
Katahdin	621	1.075	544	1.075	547	1.072	613	1.061	485	1.066	617	1.066	571	533	1.069	1.070
I.Cobbler	535	1.076	483	1.072	490	1.076	634	1.063	594	1.078	582	1.068	553	---	1.072	-----
B 355-44	573	1.083	557	1.075	475	1.0799	612	1.069	448	1.072	619	1.072	547	---	1.075	-----
R. Rural	---	-----	567	1.075	---	-----	---	-----	---	-----	---	-----	---	---	-----	-----

L.S.D. 5-percent level, 35.2 bushels.
L.S.D. 5-percent level, 0.002

MAINE

G. W. Simpson and R. Bonde

Leaf Roll Resistant Seedlings

1. Project title: Potato Tax Project 14. Leaf roll resistant seedlings.

2. Project leaders: D. Folsom, R. Bonde, and G. W. Simpson

3. Importance of the problem: Leaf roll has caused important losses in yield and quality in almost all potato-producing areas of the world. The disease has been known for a long time as a difficult one to control. It is known to be largely dependent on the green peach aphid for its spread. Serious outbreaks in this area have always been associated with unusual numbers of green peach aphids. Its incidence is usually greater following a season when numerous winged green peach aphids are produced on weeds and potatoes. The problem of leaf roll control has wide implications not only for the local area but also for those areas that buy seed.

4. Objects: The project has been designed to discover natural resistance to infection through the medium of the green peach aphid. Such resistance, which is found to a considerable degree in available material, must then be combined with other desirable characteristics.

5. Plan of work: Using all available seedlings from crosses made and seedlings grown at Beltsville, Md., field growing plants are manually infested with viruliferous green peach aphids for 3 successive years. Seedlings contracting leaf roll are of course discarded as soon as symptoms become evident. Any otherwise promising seedlings that survive the 3 years of testing are used as parents in the production of new crosses for further testing.

6. Location: Presque Isle, Maine (Aroostook Farm).

7. Results to date: During the seven seasons since this project was started, 51,150 seedlings have been infested with green peach aphids previously fed on leaf roll Katahdin plants. In the early years, using previously unselected material very few seedlings survived repeated inoculation. However, a few seedlings showing some resistance were selected as parents. When seedlings from these crosses became available, the percentage of survival increased. A few seedlings have been increased for more extensive testing. Some of these are far more resistant to leaf roll than Katahdin, which has shown considerable field resistance in this area.

   Relatively few crosses with one or two resistant parents are completely eliminated the first year. Crosses showing a fair degree of survival the first year usually show considerable resistance during the next 2 years.

About a dozen seedlings have been selected for increase to permit testing on a larger scale under field conditions. From their reaction in this rather drastic test, it is expected that they will show more field resistance than Katahdin. From among this group it is expected that at least one can be recommended for use where other methods of leaf roll control have been found to be inadequate.

Testing for resistance to leaf roll was continued at Presque Isle for a seventh season. There were 9,599 new seedlings from 65 crosses added to the test in 1950. Survivors from the 2 previous tests were retested. It is interesting to note that only 5 crosses were completely eliminated in 1950. Of the seedlings tested 13.6 percent failed to show current-season symptoms of leaf roll. This is the best showing to date.

Maine table 1. Reaction of progenies of different crosses and selfed lines to leaf roll infection resulting from artificial inoculations with viruliferous green peach aphids in each of four successive seasons.

Pedigree	Parentage	Seedlings planted 1947	Replanted			Saved for possible use as parents	
			1950	1949	1948		
		No.	No.	No.	No.	No.	Pct.
B851	X1276-185 x X96-56	206	0	3	16	0	0.0
B852	X1276-185 x X157-9	280	4	14	38	0	.0
B853	X1276-185 x B355-24	135	0	0	2	0	.0
B854	X1276-185 x X792-94	176	1	7	34	0	.0
B855	X1276-185 x B294-38	135	2	4	26	0	.0
B856	X1276-185 x B66-1	137	1	1	9	0	.0
B857	X1276-185 x B81-40	155	0	5	21	0	.0
B858	X1276-185 x Katahdin	38	0	1	1	0	.0
B859	X1276-185 x Teton	129	5	8	25	2	1.6
B860	Triumf x B294-38	63	2	4	7	1	1.6
B861	Dakota Red x X247-44	356	4	9	46	2	0.6
B862	Earlaine x X247-48	93	1	3	10	1	1.1
B863	Gr. Mt. x Triumf	112	1	3	11	0	.0
B864	Houma x X247-48	393	10	34	81	3	0.8
B865	Katahdin x Triumf	469	0	1	23	0	.0
B866	Katahdin x X247-48	491	1	3	23	0	.0
B867	Mohawk x X247-48	244	2	4	9	0	.0
B868	B24-78 x X247-24	415	34	61	88	21	5.1
B869	Sebago x 247-42	241	1	1	8	0	.0
B870	Sebago x X247-48	34	0	0	0	0	.0
B871	Shamrock x 247-48	76	0	0	5	0	.0
B872	B24-76 x B24-238	479	29	57	80	12	2.5
B873	X247-44 x Teton	529	1	5	24	0	.0
B874	X247-44 x B61-3	296	0	0	6	0	.0
B875	X247-48 x Triumf	104	2	4	5	1	1.0

Maine table 1 continued.

Pedigree	Parentage	Seedlings planted 1947	Replanted			Saved for possible use as parents	
			1950	1949	1948		
		No.	No.	No.	No.	No.	Pct.
B876	X1276-179 x X247-48	681	16	44	76	6	0.9
B877	X1276-185 x Katahdin	220	2	9	21	1	.5
B878	X1276-185 x 96-56	410	4	24	83	3	.7
B934	055 x B294-38	108	0	0	2	0	.0
B941	B294-38 x Katahdin	330	0	2	13	0	.0
B942	B294 x B294-38	242	0	6	34	0	.0
B943	B294-22 x X96-56	30	0	0	4	0	.0
B954	Houma x X 792-94	32	0	4	4	7	.0
B955	Houma x Katahdin	11	0	0	6	0	.0
B986	Houma x Z792-94	63	1	2	11	0	.0
B987	Katahdin x Z792-94	90	0	0	9	0	.0
B1164	B294-38 selfed	310	0	7	19	0	.0

Maine table 2. Reaction of progenies of different crosses and selfed lines to leaf roll infection resulting from artificial inoculations with viruliferous green peach aphids in each of three successive seasons.

Pedigree	Parentage	Seedlings planted in 1948	Replanted		Saved for retesting	
			1950	1949		
		No.	No.	No.	No.	Pct.
B2068	Chippewa x B522-33	388	3	21	0	0.0
B2071	Chippewa x X792-94	289	1	10	0	.0
B2081	Gr. Mt. x X247-48	264	9	18	2	.8
B2082	Gr. Mt. x B522-33	189	2	23	0	.0
B2089	Houma x Katahdin	61	0	4	0	.0
B2090	Houma x B445-41	137	0	6	0	.0
B2091	Houma x B522-33	211	7	39	0	.0
B2095	Katahdin x B522-33	207	0	11	0	.0
B2096	Katahdin x B445-41	239	0	0	0	.0
B2097	Mohawk x Erie	335	0	1	0	.0
B2110	Ostbote x B522-33	116	0	7	0	.0
B2112	Ostbote x X792-94	305	3	33	0	.0
B2113	Placid x B522-33	262	4	17	2	.8
B2120	Sebago x B522-33	177	0	5	0	.0
B2121	Skerry Champion x 522-33	298	0	8	0	.0

Maine table 2 continued.

Pedigree	Parentage	Seedlings planted in 1948	Replanted		Saved for retesting	
			1950	1949		
		No.	No.	No.	No.	Pct.
B2122	Starkeragis x B522-33	190	0	0	0	.0
B2123	Teton x B355-44	731	0	5	0	.0
B2125	Triumf x B522-33	69	0	2	0	.0
B2128	Virgil x B522-33	345	10	25	2	.6
B2144	X96-56 x B522-33	163	0	2	0	.0
B2146	X157-9 x B522-33	334	0	7	0	.0
B2147	X245-186 x B522-33	275	0	2	0	.0
B2149	X247-48 x Triumf	79	1	10	0	.0
B2150	X247-48 x B522-33	349	6	18	1	.3
B2151	B294-38 x B522-33	255	1	11	0	.0
B2163	B401-3 x Triumf	175	0	2	0	.0
B2166	B446-54 x Triumf	162	1	3	0	.0
B2168	B446-54 x B522-33	184	0	2	0	.0
B2169	B522-33 x X792-94	54	0	1	0	.0
B2170	X528-170 x B522-33	170	0	4	0	.0
B2171	B59-46 x Triumf	22	0	2	0	.0
B2174	X750-10 x Triumf	38	0	16	0	.0
B2175	X750-10 x B445-41	156	0	3	0	.0
B2176	X750-10 x B522-33	171	0	8	0	.0
B2179	X792-88 x B522-33	176	0	3	0	.0
B2184	X1276-185 x B522-33	56	0	3	0	.0
B2185	X1276-185 x B401-3	210	1	3	1	.5
B2186	X1276-185 x B445-41	84	0	1	0	.0
B2187	X1276-185 x B522-33	86	0	5	0	.0
B2189	41956 x B 522-33	433	3	18	0	.0
B1189	X247-48 selfed	72	8	16	3	4.2
B1190	B 294-38 "	228	2	18	0	.0
B1201	X 792-94	92	0	19	0	.0

Maine table 3. Reaction of progenies of different crosses and selfed lines to leaf roll infection resulting from artificial innoculations with viruliferous aphids in 1949 and reinoculation in 1950.

Pedigree	Parentage	Seedlings planted in 1949	Replanted 1950		Surviving 2nd innoculation in 1950 and saved	
		No.	No.	Pct.	No.	Pct.
B2351	Houma x B582-33	82	9	11.0	3	3.7
B2352	WSC17 x B582-33	82	9	11.0	5	6.1
B2353	WSC17 x B1122-25	105	26	24.8	18	17.1
B2354	B24-78 x B582-33	80	17	21.3	8	10.1
B2355	B522-33 x Triumf	86	7	8.1	2	2.3
B2356	B582-33 x B607-56	146	7	4.8	0	.0
B2357	B582-66 x B584-11	156	68	43.6	23	14.7
B2358	B859-14 x B582-33	109	0	0	0	.0
B2359	B1122-25 x B24-78	331	101	30.5	64	19.3
B2360	B1122-25 x B584-11	168	29	17.3	11	6.5
B2361	B1122-25 x 1241-90	77	2	2.6	0	.0
B2362	B1122-25 x 1276-185	48	10	20.8	6	12.5
B2363	B1122-25 x B607-56	329	6	1.8	0	.0
B2364	1276-185 x B1122-25	55	11	20.0	7	12.7
B2365	1276-185 x B445-41	523	17	3.3	0	.0
B2366	1276-185 x B582-33	50	14	28.0	10	20.0
B2367	B859-19 x B582-33	52	5	9.6	0	.0
B2374	B582-33 x B522-33	250	28	11.2	2	.8
B2375	B582-33 x B1122-25	119	7	5.9	3	2.5
B2376	B582-33 x 1241-90	46	0	0	0	.0
B2377	B582-33 x 1241-91	126	1	0.8	0	.0
B2378	B583-66 x B582-33	144	31	21.5	23	16.0
B2379	B583-66 x 1241-91	51	9	17.6	2	3.9
B2380	B673-76 x B582-33	216	16	7.4	4	1.9
B2381	B673-76 x B1122-25	162	14	8.6	9	5.6
B2382	B673-76 x 1276-185	155	24	15.5	9	5.8
B2384	B778-15 x B582-33	166	10	6.0	0	.0
B2385	B779-1 x B582-33	109	8	7.3	0	.0
B2419	B478-1 x 96-44	171	3	1.8	0	.0
B2420	B478-1 x 157-9	354	30	8.5	0	.0
B2422	B478-1 x B446-58	131	3	2.3	0	.0
B2423	B478 x B582-33	313	33	10.5	1	.3
B2449	Houma x Netted Gem Mutant	381	100	26.2	11	2.9
B2575	B446-54 x B247-48	148	11	7.4	1	0.7
B1220	WSC23 selfed	109	0	0.	0	.0
B1221	B24-78 selfed	150	35	23.3	24	16.0

Maine table 4. Reaction of progenies of different crosses and selfed lines to leaf roll infection resulting from artificial inoculation with viruliferous aphids in 1950.

Pedigree	Parentage	Seedlings planted in 1950	Saved for retesting in 1951	Surviving the first year's test
		No.	No.	Pct.
B1269	Placid selfed	88	4	4.5
B1298	Triumf selfed	13	0	.0
B1311	1241-91 selfed	82	4	4.9
B2834	294-38 x 157-9	230	54	23.5
B2835	294-38 x 528-170	226	24	10.6
B2860	B899-48 x Aquila	59	8	13.6
B2904	B301-29 x B61-3	161	2	1.2
B2905	B301-29 x B355-35	152	3	2.0
B2925	1276-185 x B76-23	275	49	17.8
B2926	1276-185 x B355-44	289	43	14.9
B2929	Empire x B1153-10	199	8	4.0
B2930	Empire x B929-6	122	4	3.3
B2931	Empire x B872-70	107	20	18.7
B2932	Kennebec x B872-70	24	6	25.0
B2933	B779-1 x Aquila	169	7	4.1
B2937	Virgil x B522-33	102	13	12.8
B2938	B355-44 x B522-33	416	34	8.2
B2939	B583-66 x B582-33	190	88	46.3
B2940	B584-11 x B1122-25	44	15	34.1
B2941	B673 x B1122-25	224	76	33.9
B2942	1276-185 x B355-24	82	8	9.8
B2943	Aquila x Triumf	28	2	7.1
B2945	Houma x Aquila	172	26	15.1
B2946	Houma x Triumf	71	13	18.3
B2947	Katahdin x Triumf	104	7	6.7
B2948	Katahdin x B578-39	36	4	11.1
B2949	B420-174 x Triumf	204	39	19.1
B2950	B420-186 x Katahdin	70	1	1.4
B2951	B420-186 x Triumf	44	4	9.1
B2952	B514-14 x Katahdin	130	9	6.9
B2953	B514-14 x B446-8	261	7	2.7
B2954	B514-14 x B578-39	207	28	13.5
B2955	B572-92 x Katahdin	223	11	4.9
B2956	B572-92 x B 778-43	64	1	1.6
B2957	B583-66 x 927-3	25	0	.0
B2958	B583-66 x B986-7	212	83	39.2
B2959	B583-67 x B872-70	172	41	23.8
B2960	B864-17 x Aquila	240	14	5.8
B2961	B864-17 x B983-9	178	0	.0
B2963	B876-63 x Aquila	384	15	3.9
B2964	B976-63 x B872-70	68	5	7.4
B2965	B876-63 x B986-7	283	28	9.9
B2967	927-3 x B878-28	86	4	4.7
B2970	B574-14 x B778-43	47	0	.0

Maine table 4 continued.

Pedigree	Parentage	Seedlings planted in 1950	Saved for retesting in 1951	Surviving the first year's test
		No.	No.	Pct.
B2971	B574-14 x B872-70	230	36	15.7
B2973	Aquila x B878-28	46	4	8.7
B2975	B577-132 x B962-32	192	5	2.6
B2976	B583-66 x B872-70	292	71	24.3
B2977	B583-67 x B578-39	179	52	29.1
B2979	B778-43 x B578-39	55	1	1.0
B2980	B606-3 x B986-7	83	2	2.4
B2981	B864-2 x Triumf	46	5	10.9
B2982	B864-2 x B929-6	76	5	6.6
B2983	B864-17 x B986-7	78	26	33.3
B2984	B872-70 x B962-32	87	3	3.5
B3016	B478-1 x B582-33	153	15	9.8
B3022	B724-1 x Ruska	183	7	3.8
B3024	B724-20 x B872-70	94	5	5.3
B3025	B864-2 x B724-1	132	4	3.0
B3028	B577-44 x B724-1	82	0	.0
B3037	Empire x B355-35	35	1	2.9
B3038	Empire x B355-44	240	7	2.9
B3039	Empire x B434-91	187	15	8.0
B3044	B294-22 x B355-44	319	6	1.9
B3045	B294-22 x B522-33	247	35	14.2

MARYLAND

R. A. Jehle

Project title: Disease resistance in potatoes with special reference to late blight, scab, and virus diseases.

Leader: R. A. Jehle, State Plant Pathologist

Objects: (1) To find potato varieties that are more resistant to diseases than standard varieties, that yield as well or better, and that have as good or better table and marketing qualities, and (2) to find better methods for maintaining seed stocks, producing certified seed and marketing these new varieties.

Plan of Work: Certified seed of new and old potato varieties is obtained from various sources; also promising seedlings from crosses made for the U.S.D.A. breeding program. These are planted in test plots in the most important potato-producing areas. They are then studied to determine their resistance to diseases, yield and vigor, table and marketing qualities and vine characters, with special attention to the masking of virus-disease symptoms which make seed-stock maintenance very difficult or impossible.

Location: 1. Garrett County at Oakland where the elevation is over 2,000 feet.

2. Worcester County at Pocomoke, the center of the Eastern Shore potato-producing area.

3. Wicomico County, Eastern Shore at the University Farm near Salisbury, where there are a few commercial growers, but where potatoes are grown mostly for home use.

4. Queen Anne County, northern Eastern Shore at Centerville and Crumpton where there are a few commercial growers, but where potatoes are grown mostly for home use.

Results to Date: Weather conditions were only fairly favorable for potato production in Maryland in 1950. In Garrett County stands were good and yields were a little above normal. On the Eastern Shore in the early crop a period of drought preceded and followed by a rainy period caused much second growth in some varieties. Yields from the early crop on the Eastern Shore were a little above normal. Weather conditions for the late crop were not very favorable because of a long dry period followed by much rain, and even where good stands were obtained, yields were somewhat below normal. Stands from whole seed were very good but stands from cut seed varied with local weather conditions, soil type, storage condition of the seed, and variety. The performance of 35 varieties and 10 seedlings was studied in Maryland in 1950.

Eastern Shore, Pilchard Farm, Pocomoke, Md.

Early Crop: On March 16 a potato variety yield test was planted at Pocomoke, Md. A number of varieties with the seed from various sources were planted in five randomized blocks. The data for this test are given in Maryland table 1.

The largest yield was obtained from home-grown Maryland seed. Essex grown from Garrett County seed ranked second. However, if the least significant difference at the 5% level is used as the measure, Essex, Garrett-County-grown, barely outyielded Irish Cobbler, Maine-grown. Essex produced much second growth, especially in the plots grown from home-grown seed. There was also very much in Ontario, some in B 164-15, Teton, Pungo, B 61-3, and a little in Katahdin. LaSoda and Marygold were the earliest-maturing varieties that outyielded Irish Cobbler, but the yellow flesh of Marygold and the red skin of LaSoda are undesirable in some markets. Many of the varieties and seedlings that yielded significantly as well as Maine Irish Cobbler were preferable in appearance and disease resistance, but most of them matured later. Pawnee matured at about the same time as Irish Cobbler and produced smoother tubers. Of varieties that matured 10 days to 2 weeks later than Irish Cobbler, Katahdin, Canus, and Chippewa all had smoother tubers than Irish Cobbler. Seedling B 61-3, which is scab-resistant, had shallower eyes, but gave a poor stand and had too much second growth. Of the varieties that matured later than Katahdin, Kennebec, Pungo, and B 69-16, all of which are very resistant to late blight, had smoother tubers than Irish Cobbler. Sebago tubers and tubers of B 164-15, which is an excellent baker, were also smoother than Irish Cobbler. Snowdrift had smooth tubers but was undesirable because of vine characters which mask virus diseases. Of the varieties that yielded significantly less than Irish Cobbler, White Cloud, Progress, and 1276-185 were promising and will be tested again in 1951.

University Farm, Salisbury (early crop)

Seven named varieties and one seedling variety were planted in 5 replications in 50-plant rows in randomized blocks. The data for this test are given in Maryland table 2.

B 164-15, Essex, and Kennebec outyielded Katahdin and Irish Cobbler. Unlike the plot on heavier soil at Pocomoke, all of the varieties were mature when they were harvested on July 19, and there was no second growth on any of the tubers. Thus the performance of varieties in one soil type cannot be judged from results of tests conducted in a different soil type.

University Farm, Salisbury (late crop)

A variety test plot was planted at University Farm, Salisbury, on July 13, in five 25-hill rows in randomized blocks. In Maryland it is often difficult to get good stands for the late crop because the seed potatoes from the previous fall must be kept in cold storage during the summer months, and the weather is frequently hot and dry when the crop is planted. The data for these tests are found in Maryland table 3.

Maryland table 1. Yield data of varieties tested on the Pilchard Farm, Pocomoke, Md., 1950.

Variety or seedling	Source of seed	Yield per acre U.S. No. 1	Variety or seedling	Source of seed	Yield per acre U.S. No.1
		Bu.			Bu.
Marygold	Pocomoke	436	Chippewa	Maine	266
Essex	Garrett Co.	392	Pontiac	Garrett Co.	262
"	Pocomoke	371	Sebago	Pocomoke	254
LaSoda	Nebraska	396	Snowdrift	Maine	250
B 164-15	Garrett Co.	358	Irish Cobbler	Pocomoke	247
Katahdin	Pocomoke	355	Yampa	Garrett Co.	213
Teton	Garrett Co.	330	Sebago	"	213
Canus	"	317	1276-185	"	213
Katahdin	"	313	White Cloud	"	209
Marygold	"	310	B 61-3	"	196
Irish Cobbler	Maine	309	Kennebec	Pocomoke	183
Pawnee	Pocomoke	299	White Pontiac	Garrett Co.	167
B 69-16	Garrett Co.	286	B 355-44	Maine	165
Pungo	Maine	286	Progress	Garrett Co.	158
B 61-3	Garrett Co.	284	Seneca	"	123
Kennebec	"	279	Ontario	"	102
B 320-76	"	269			
			L.S.D. at 5% level		78
			L.S.D. at 1% "		103

Maryland table 2. Yield data for varieties tested at the University Farm, Salisbury, Md., in 1950. Mature, July 19.

Variety or seedling	Yield per acre U. S. No. 1
	Bu.
B 164-15	199
Essex	197
Kennebec	191
Sebago	171
Marygold	158
Seneca	156
Katahdin	108
Irish Cobbler	106
L.S.D. at 5% level	59

Maryland table 3. Yield data of varieties tested at University Farm, Salisbury, Md., in 1950. Late crop planted July 13.

Variety or seedling	Kind of seed	Yield per acre U. S. No. 1
		Bu.
B 355-44	Cut	255
White Pontiac	Whole	195
Pontiac	"	177
Calrose	"	176
Kennebec	"	164
Essex	"	148
Marygold	"	145
Ontario	"	139
B 164-15	"	136
Kennebec	Cut	133
Calrose	"	120
Seneca	Whole	120
LaSoda	Cut	120
B 61-3	Whole	119
Yampa	Cut	112
L.S.D. at 5% level		24

Six varieties and one seedling were grown on a farm in Queen Anne County at Crumpton on the northern Eastern Shore. One row of each variety was grown, and the following yields per acre of U. S. No. 1 potatoes were obtained: Kennebec, 394 bushels; B 69-16, 330 bushels; Essex, 325 bushels; Progress, 276 bushels; Ontario, 254 bushels; Calrose, 245 bushels, and LaSoda, 191 bushels.

Another late potato plot was planted on the University Farm on July 13 using early grown seed. In some of the plots the seed was treated with ammonium thiocyanate to hasten sprouting. In most plots the yields and stands from this plot were only fair. The largest yield was obtained from Progress treated with ammonium thiocyanate, 105 bushels U. S. No. 1 potatoes per acre, but the yield from the check plot treated with water only was 95 bushels which was not significantly less (L.S.D. at 5% level, 24 bushels). The yield from treated LaSoda, 65 bushels per acre, was not significantly different from the yield from treated Marygold, 53 bushels. The yield from treated 1276-185, 48 bushels, was not significantly less than the yield from treated LaSoda and treated Marygold, but the yields from treated Irish Cobbler, 38 bushels, and treated White Cloud, 30 bushels, were less than the yields from treated LaSoda and treated and check Progress.

Garrett County

All seed was planted in tuber units in 5 randomized replications each containing 20 units. Varieties were harvested prior to September 15.

Five varieties and two seedlings were grown in a field sprayed with Bordeaux mixture 4-4-50, 8 times, four of the applications containing 1 pound of 50% wettable DDT; also one very early application using one pound of 50% wettable DDT in 50 gallons of water. The data for this test are given in Maryland table 4.

Varieties harvested after September 15. In an adjoining field 10 varieties and 5 seedlings were grown in a field that was sprayed 10 times with Bordeaux mixture 4-4-50, to which one pound of 50% wettable DDT was added in every other application; also with one very early application with 1 pound of 50% wettable DDT in water. The data for this test are given in Maryland table 5.

Potomac gave the largest yield, 545 bushels of U. S. No. 1 potatoes per acre, followed closely by Kennebec with 526 bushels.

In an adjacent field that received 4 applications of 50% wettable DDT (1 pound in 50 gallons water) 15 varieties and 5 seedlings were planted in 4 randomized replications. Late blight appeared in this field early in August, and the vines of all susceptible varieties soon became severely diseased. Vines of the earlier susceptible varieties like Irish Cobbler, Marygold, Canus, and Katahdin were dead soon after the middle of August, and a few days later vines of later-maturing susceptible Pontiac and Mason and the moderately resistant Sebago, Potomac, and seedlings B 164-15 followed suit. Early blight made its appearance about the third week in August, and by September 6 when the entire plot was dug few green vines remained in any

Maryland table 4. Yield data of seven potato varieties in Garrett County, Md., sprayed with Bordeaux mixture 4-4-50, eight times, four of the applications containing 1 pound of 50% wettable DDT in 50 gallons of water.

Variety	Yield U. S. No. 1 per acre
	Bu. 1/
Essex	429
Yampa	387
B 61-3	383
Marygold	364
Katahdin	335
B 320-76	321
Irish Cobbler	306
White Cloud	236

1/ The variability was so great that there was no significant differences between yields.

Maryland table 5. Yield data for 10 varieties and 5 seedlings grown in the field in Garrett County, sprayed 10 times with Bordeaux mixture 4-4-50, to which 1 pound of 50% wettable DDT was added in every other replication.

Variety	Yield U. S. No. 1 per acre
	Bu.
Potomac	545
Kennebec	526
B 164-15	484
Ontario	482
B 69-16	466
White Pontiac	461
Calrose	442
B 73-18	432
Pontiac	424
Sebago	423
Rural (Mason)	420
Seneca	369
Teton	358
C.G. 3175	286

variety. Traces of late blight were found in every variety, even in Essex, Kennebec, Sequoia, and B 69-16, which are usually very resistant. Late blight tuber rot was not prevalent in the field, but a moderate amount was found in Sequoia, B 164-15, B 73-18, and Essex. With the exception of Pontiac, the largest yields were obtained from the varieties that were most resistant to late blight. The large yields from Pontiac were probably due to its early tuberization. The yield data for this test are given in Maryland table 6.

During the years 1945 to 1950, inclusive, seven of the same potato varieties were included in the Garrett County test plots each year. Average yields obtained from these varieties were as follows: Potomac, 455 bushels per acre U. S. No. 1 potatoes; Sebago, 383 bushels; Pontiac, 370 bushels; Smooth Rural (Mason) 359 bushels; Marygold, 312 bushels; Katahdin 278 bushels; and Irish Cobbler, 226 bushels.

The comparative yields from adjoining fields, one receiving applications of Bordeaux mixture with DDT and the other applications of DDT only have been obtained for the past 5 consecutive years, but all varieties have not been included in the tests every year. Average gains resulting from including the Bordeaux mixture with the DDT in the spray schedule 3 to 5 years were as follows: B 164-15, 175 bushels per acre of U. S. No. 1 potatoes, 4 years; Potomac, 151 bushels, 4 years; Smooth Rural (Mason), 117 bushels, 5 years; Calrose, 89 bushels, 4 years; Sebago, 87 bushels, 5 years; Marygold, 56 bushels, 4 years; Katahdin, 56 bushels, 3 years; Sequoia, 50 bushels, 3 years; Irish Cobbler, 43 bushels, 4 years; Kennebec, 40 bushels, 3 years; and Pontiac, 25 bushels, 3 years.

These results demonstrate the value of using a fungicide in potato spray schedules regardless of resistance to late blight. In spite of this fact, it is advantageous to plant varieties resistant to late blight, because the disease is easier to control in such varieties, especially during seasons that favor its development.

Brief summary of results from tests with potato varieties and seedlings that have given the best results in Maryland:

Kennebec has been found to give high yields, to be very resistant to late blight, and to have excellent table quality wherever it has been tested in Maryland. It has given excellent yields in Garrett County and also for both early and late planting on the Eastern Shore. When planted for the early crop it matures later than Katahdin.

Sebago has given almost as good results as Kennebec, and the shape of the tubers has been more uniform, but it is not as resistant to late blight and good stands are more difficult to obtain when it is used to plant the late crop.

Pontiac (red and white) has also given satisfactory results wherever it has been tested, but it has no resistance to late blight and is quite susceptible to scab.

Maryland table 6. Yield data for 15 varieties and 5 seedlings grown with no fungicide but with four applications of 50% wettable DDT (1 pound in 50 gallons of water).

Variety	Yield U. S. No. 1 per acre
	Bu.
Kennebec	436
Sequoia	462
B 69-16	403
Pontiac	395
White Pontiac	386
Calrose	366
Ontario	351
Sebago	337
Seneca	335
Essex	324
Potomac	314
B 61-3	316
B 164-15	313
Marygold	285
Rural (Mason)	280
B 73-18	263
Canus	229
Irish Cobbler	221
Katahdin	207
B 320-76	154
L.S.D. 5% level	98
L.S.D. 1% "	130

Marygold has also been satisfactory wherever it has been tested, but like Pontiac, it has no resistance to late blight and is quite susceptible to scab. It has a light yellow flesh that is objectionable in some markets. Its chief merits are its large yields of smooth attractive tubers that set very early.

Ontario has been our most promising scab-resistant variety, and in 1950 it yielded well in Garrett County and in the Eastern Shore late crop. However, in the Eastern Shore early crop, the yield was poor and there was much second growth.

Essex yielded very well wherever it was planted. It was very resistant to late blight in some localities, but in others it was not as resistant, and some late blight tuber rot developed. Considerable second growth developed in Essex when it was planted for the early crop on the Eastern Shore.

B 69-16 has been a very promising seedling during the past 3 years, especially in Garrett County where its average yield during the past 3 years was 514 bushels per acre of U. S. No. 1 potatoes. It was very resistant to late blight and has smooth uniform tubers. Although the vines mature late, it produces tubers early.

Katahdin has smooth, attractive tubers and matures somewhat later than Irish Cobbler and has yielded a little better. It has no resistance to late blight.

Irish Cobbler matures early, but has deep eyes and no resistance to late blight. It seldom produces high yields, and its chief merit is its early maturity.

Potomac is suitable for planting in Garrett County on soils not infested with the scab organism. It is a high yielder and has some resistance to late blight. Results from planting it on the Eastern Shore have only been fair.

LaSoda, Canus, Pawnee, Pungo, Yampa, White Cloud, Progress, and seedlings B 355-44, B 61-3, and B 164-15 all have desirable qualities but need further study before their value for planting in Maryland can be determined.

MASSACHUSETTS

Ralph Donaldson and Karol J. Kucinski

Fourteen named and numbered varieties of potatoes were tested in 1950 for yield at the Massachusetts Agricultural Experiment Station, Amherst, Mass. The data for these tests are given in Massachusetts table 1.

Ontario ranked first in yield, but there was probably no significant difference between it and six other varieties --Sequoia, Green Mountain, Kennebec, Essex, Mohawk, and Chippewa. Katahdin yielded the least of all the varieties in the test.

Mass. table 1. Yield data for the potato variety tests grown at the Massachusetts Agricultural Experiment Station, Amherst, Mass., in 1950

Rank	Variety	Yield per acre Size A	Yield per acre Size B	Total yield per acre
		Bu.	Bu.	Bu.
1	Ontario	495	14	509
2	Sequoia	481	28	509
3	Green Mountain	477	22	499
4	Kennebec	475	35	510
5	Essex	472	15	487
6	Mohawk	456	35	491
7	Chippewa	456	3	459
8	Sebago	419	19	438
9	B 637-14	415	37	452
10	Marygold	407	15	422
11	Teton	401	8	409
12	Cobbler	391	18	409
13	B 355-44	382	19	401
14	Katahdin	300	12	312

MICHIGAN

J. H. Muncie and M. R. Hatfield

Approximately 10,000 potato seedling progeny from 39 crosses grown in the greenhouse were tested for resistance to scab at the Lake City Experiment Station. From these tests, 46 hybrid selections were made for further trials in 1951.

Advanced seedling selections from six crosses were grown by five commercial growers in field tests for adaptability. With one exception, yields were good and further selections of three of the hybrids were made by the growers for 1951 planting.

Field tests were continued for resistance to stem-end dry rot caused by Fusarium solani var. eumartii. These comprised 5-hill lots of 373 seedlings and 11 commercial varieties. Of these, 204 were furnished by Professor E. J. Wheeler, 36 by Dr. F. J. Stevenson, and 4 by Dr. H. O. Werner. In Mich. table 1 is given the reaction to stem-end dry rot of 42 seedlings selected for further tests in 1951.

Mich. table 1. Reaction of potato seedlings to infection by Fusarium solani var. eumartii

Seedling	Infection	Seedling	Infection
	Pct.		Pct.
R 50-11	40	B 313-73	55
R 61-3	15	B 355-24	50
R 62-1	30	B 434-91	30
R 112-7	25	B 499-27	10
R 112-9	20	B 505-3	30
R 113-24	10	B 515-2	45
R 121-8	15	B 528-173	35
R 125-4 x 627-126	5	B 593-11	25
R 132-9	30	B 595-76	55
R 133-2	35	B 598-29	15
R 133-16	35	B 607-72	15
R 134-3	30	B 721-35	30
R 136-1	30	B 929-28	5
R 138-3	50	B 929-32	35
R 147-1	35	Teton	35
R 147-2	25	48-4-1	30
R 150-8	25	48-6-5	30
R 166-3	15	48-15-4	35
R 1382-4	30	48-18-1	30
R 1469-3	35	528-118 x Sebago	20
R 1747-5	50		
R 1950-16	30		

Specific gravity and alcohol tests (Wheeler method) were made on 44 seedlings used in disease-resistance trials with results as shown in Mich. table 2.

Mich. table 2. Results of specific gravity and alcohol tests.

Seedling	Specific Gravity	Alcohol test [1]
B83-9	1.0690	7.50
B96-44	1.0710	6.50
B204-4	1.0739	7.50
B351-44	1.0868	6.00
B355-24	1.0658	6.00
B381-2	1.0785	2.25
B395-5	1.0707	6.00
B446-8	1.0755	5.00
B446-25	1.0775	4.75
B461-32	1.0773	6.00
B499-27	1.0658	7.50
B505-53	1.0650	6.25
B594-16	1.0728	6.00
B598-29	1.0826	6.75
B607-72	1.0682	6.25
B608-66	1.0687	5.75
B721-35	1.0701	8.00
B759-26	1.0643	6.75
B762-7	1.0736	6.00
B766-45	1.0630	7.00
B765-80	1.0650	7.50
B921-3	1.0809	7.00
B922-3	1.0651	6.75
B929-28	1.0808	7.25
B929-32	1.0782	3.50
B961-17	1.0673	3.75
B962-26	1.0820	8.00
B962-50	1.0838	7.50
B991-2	1.0841	7.25
B991-13	1.0759	3.00
B1127-97	1.0731	6.25
Crain Beauty	1.0829	6.00
C.S. 6317	1.0651	6.25
48-3-1	1.0746	7.25
48-6-1	1.0850	7.75
48-6-13	1.0744	7.00
48-7-3	1.0874	7.00
48-13-3	1.0666	8.00
48-17-3	1.0767	8.00
48-17-6	1.0653	8.00
46-1	1.0744	7.70
46-2	1.0757	7.60
46.3	1.0757	7.75
Progress	1.0759	7.25

[1] Wheeler alcohol test for cooking quality: 1 = Dark brown discoloration; 8 = (no discoloration of tuber plug) white.

MICHIGAN

E. J. Wheelor and H. C. Moore

Potato breeding is the project title given to the cooperative agreement between the Farm Crops Department of Michigan State College and the Division of Fruit and Vegetable Crops and Diseases of the United States Department of Agriculture. The project has been in operation since 1929. At first it included only the testing of superior seedlings later named Katahdin, Chippewa, and Sebago varieties furnished by the United States Department of Agriculture.

The project leaders have been H. C. Moore and E. J. Wheeler, assisted by extension specialists, sub-station superintendents, members of other departments at the college, and the generous assistance of many interested farmers whose farms have been available for extended tests.

The low yields of many of the older varieties and the increase of common scab and other diseases have been important factors in promoting interest in this project. Also, the reluctance of the trade to accept the Russet Rural variety has created an interest on the part of the growers to become more interested in new white-skin varieties. The reclamation of muck soils for potato production has created a problem to develop new varieties better adapted to these previously unused areas in southern Michigan.

Objects of the research is to develop, test, and introduce to the growers outstanding new varieties that are superior in culinary quality, higher yields, resistant to many of the major diseases, and many other minor factors. A large number of companies manufacturing potato chips located in this area have requested work in the development of new varieties that will store and provide a conditioned supply of desirable potatoes for the late winter and early spring months.

A plan of work is provided to obtain parent material for hybridization that is superior in yield, resistant to disease, and has good culinary quality. A program to test seedlings from previous introductions is carried out each year in the field and laboratory. The parents are crossed in the greenhouse and the seedlings are subjected to rigid tests. Outstanding seedlings and new varieties obtained from other cooperators are also incorporated into many of the crosses. Many of the seedlings and varieties acquired from others are tested along with the Michigan selections.

The greenhouse at East Lansing is used for hybridization and the growing of the first-year seedlings from true seed. The scab and yield test is conducted at the Lake City Experiment Station. The college muck farm located a few miles from East Lansing is used for the testing of seedlings for muck soils. The farm of Reisner Brothers & Hopp, Rogers City, is used for the testing of scab resistance and the production of clean seedlings to furnish seed to be used in other tests. A farm at Munuscong is used to determine the fertility of seedlings as this location is favorable in climate for seedball production. Late blight is often encountered, therefore a test for late blight resistance is often possible in the parent material.

The results to date have been very encouraging. During the last 15 years the new varieties have replaced approximately one-half the acreage formerly planted to the older established varieties. New varieties, especially the Kathadin, Chippewa, Sebago, and Pontiac, and to a lesser extent the Sequoia, Menominee, and Erie, have led in this acreage replacement. The gain has been at the expense of such varieties as Russet Rural, White Rural, White Rural, Green Mountain, and Irish Cobbler. The Sebago has been given the most emphasis the past few years because of its high yields under irrigation. The market has also recognized such qualities in it as high dry matter and the white color of the cooked tubers.

The Pontiac is favored by restaurants for a french-frying potato. The inability of the Pontiac to make a light-colored chip apparently favors it for a golden-brown french frier.

Michigan table 1 gives the total yield, specific gravity, and color of eight varieties and two seedlings grown at Lake City in 1950. The high specific gravity of Irish Cobbler, Russet Burbank, Sebago, and Kennebec is the same as results from previous years. The high specific gravity of the Russet Rural has reached this height only under the most favorable growing conditions. The 1950 season was very favorable. The dry matter of the other varieties and the two seedlings have been low in tests conducted in previous years.

The color test was determined by taking a core from near the stem end of the tuber. These cores were soaked in a 95-percent ethyl alcohol solution for approximately 2 hours. The amount of gray discoloration in the cortical region of the core determined the number assigned in the color test. A reading of eight indicates no color present. The lower numbers below eight indicate the degree of coloring that will be in the tuber after boiling.

Michigan table 2 gives the number of seedlings having extremely low specific gravity when grown on muck and mineral soils.

Five hundred seedlings were planted in five-hill lots at the college muck farm. One hundred and thirty-two were selected at harvest as having commercial value from the tuber shape, size, and yield. After specific gravity and the color test had been run, 24 were of high dry matter and good color. This group will be included in a yield test along with such varieties as Chippewa, Sebago, and Katahdin.

Four seedlings, B 505-3, B 69-17, R 100-3, and B 93-12-5, were increased so that sufficient amounts of seed will be available for distribution to several farmers. All have scab resistance. Seedling No. R 125-4 is favored by many growers. It is susceptible to internal necrosis, a character dooming it, even though it has given very high yields and matures along with Irish Cobbler planted at the same time.

Another project that has paralleled potato breeding is the seeding of rye preceding the potato crop. Over a 12-year period the rye plots conditioned soil to the extent that scab no longer was a problem. From the results of the experiment over 50 percent of the Michigan potato growers are now using rye. If it is not impossible to control scab perfectly with rye as a

green-manure crop many more seedlings with only slight scab resistance have a chance of becoming a named variety.

The latest addition to our projects is a study of agronomic factors that have a bearing on preparing potato varieties for the manufacture of better potato chips. Many seedlings will be included in this project.

Michigan table 1. Total yield, specific gravity, and color of varieties and seedlings from yield tests in 1950 at the Lake City Experiment Station, Lake City, Mich.

Variety or seedling	Yield per acre	Specific gravity	Color test 1/
	Bu.		
Irish Cobbler	254	1.082	6.9
529-2	236	1.068	7.3
125-4	351	1.078	6.6
Katahdin	270	1.077	7.7
Russet Rural	359	1.086	7.6
Russet Burbank	230	1.087	7.3
Sebago	345	1.084	7.9
Chippewa	290	1.074	7.8
Kennebec	343	1.086	7.6
Pontiac	476	1.074	7.4

1/ Color determined by alcohol test. The number 8 denotes white color after cooking with graduation of color intensity increasing as the lower figures are approached.

Michigan table 2. Total number of seedlings tested from muck and mineral soils with the number of each having a specific gravity reading below 1.064 or above 1.088.

Kind of soil	Seedlings tested	Number below 1.064	Number above 1.088
	No.		
Muck	132	13	0
Mineral	273	2	7

MINNESOTA

F. A. Krantz and Carl J. Eide

Project Title: Potato Breeding.

Project Leaders: F. A. Krantz and Carl J. Eide.

Assistants and Cooperators: C. H. Griffith, B. C. Beresford Branch Stations; F. A. Gowen (Horticulture), Florian Lauer (U.S.D.A.); O. C. Turnquist, Agric. Extension; A. G. Tolass, Potato Seed Certification.

Importance of problem: The potential improvement of potatoes through breeding has hardly been touched. One can theoretically construct innumerable improved varieties by combining on paper the desirable specific characters readily available among the named varieties. To these characters can be added the equally large if not greater number of characters available in the material grown as numbered selections in the breeding nurseries. The problem of combining into useful combinations the many economic characters, (horticultural, disease-and insect-resistant, market and culinary) has been discussed in Minnesota Technical Bulletins 25, 58, and 173, and breeding procedures for combining these characters have been suggested.

These characters include yield and adaptibility; maturity (short- and long-season varieties); frost and drought resistance; resistance to injuries caused by flea beetles, leafhoppers, aphids, and psyllids; resistance to the numerous virus diseases, such as mild, latent, and veinbanding mosaics, yellow dwarf, spindle tuber, and leaf roll; and resistance to late blight and early blight. Desired tuber characters concern shape, smoothness, depth of eye, freedom from knobs and growth cracks, length of stolons, high and low tuber set, uniformity of size of tuber, length of rest period, internal composition, dry matter, starch, and vitamin content, cooking quality, mealiness, blackening, hollow heart, hair sprout, resistance to tuber rots initiated by the fungi and bacteria that cause late blight, early blight, common scab, black wart, fusarium rot, and bacterial wilt.

Most, if not all the above characters, have been studied. For most of them selection technics have been published. The task of the plant breeder is to combine them into varieties suitable for commercial production and consumption.

Objectives: To develop productive varieties, adapted for production in Minnesota, for handling and transportation from field to consumer; and acceptable to the consumer; and to develop logical breeding procedures and effective selection technics for combining the characters listed above into the desired varieties.

Plan of Work: The general method of procedure has been to use alternate cycles of inbreeding and outbreeding to develop parents that individually will possess an increasingly large number of the desirable characters, with a relatively high degree of homozygosity for these characters. These

parents are used to produce F_1 progenies which are tested for superior individuals with sufficient improvement to be introduced as new varieties. Work under this general procedure is planned with the objective of securing information that would faciliate breeding and selection for special characters.

Location: The breeding work is located at University Farm, at the branch stations at Grand Rapids and Crookston, Rosemount, Castle Danger, and at Grand Forks, with the Red River Grower's Association at Hollandale, with the Southern Minnesota Vegetable Grower's Association, and with individual growers at selected locations in the State.

Horticultural Characters: O. C. Turnquist made a study of specific gravity of potatoes, utilizing about 30 varieties and selections, 24 locations, and 5 seasons. He also studied the relation between the specific gravity of parents and a number of F_1 progenies. Range of specific gravity between varieties and between locations was about the same. Varieties reasonably well adapted to a location as indicated by yield tended to keep their relative rank in respect to specific gravity. W. A. Oitto studied the relation of parents to progeny in 3 crosses for their horticultural characters over 4 seasons, including their seedling behavior in the greenhouse. F. A. Gowen for the past 2 seasons has studied variation in successive selfed generations of economic characters, and the general and specific combining ability of selections from different self generations. Y. R. Mehta studied vitamin C content of parents and F_1 progeny in relation to yield, maturity, and specific gravity of tubers. Using 2 parents of slightly above average vitamin C content, he found that the variation due to seasons (2) and locations (2) and the difference between the seedlings was less than for yield and specific gravity. Seedlings gave a differential response to loss of vitamin C in storage. Breeding for retention in storage appeared to offer as much promise as for absolute vitamin C content.

Retail consumer acceptance was tested on nine varieties produced commercially in the Red River Valley. Using three varieties to a test all possible combinations of the nine varieties were tested in three of six retail stores. This study may supply information on qualities considered by retail customers and on the possible need of testing consumer acceptance of selections before introduction.

Florian Lauer has the past season begun exploring the potentialities of graft produced chimeras in a potato-improvement program. Varieties, such as the Russet Burbank, Russet Rural, Red McClure, Red Warba, and Red Pontiac are chimeras resulting from natural mutations in clonal varieties. Chimeras are not uncommon in asexually propagated material (both crops and ornamental plants), and their nature has the subject of extensive research. They have been produced in many species by grafting related species and varieties. The possible application of this information to the improvement of asexually propagated crops has received little attention. In Europe R. H. Riffin (1902) grafted one variety of potato onto another and obtained tubers with mixed tissues. C. A. Jorgenson (1927) produced a periclinal tomato potato chimera but was unsuccessful in attempts to produce a chimera of potato having a skin of tomato, with the objective of making the potato immune to infection by Phytophthora. Winkler suggested the theoretical possibility of a chimera

of two kinds of potato, the skin composed of a variety immune to Phytophthora. More recently Krenke (1933) has attempted to realize this possibility. The Minnesota Station has begun exploratory work in grafting onto the best commercial types, periderm of varieties resistant to common scab, late blight, and a number of virus diseases, and of varieties with a more desirable texture and color periderm. The replacement or the supplementation of the periderm of one variety for another would supply material of considerable value for theoretical studies as well as for economic purposes.

The following advanced selections are being increased:

Selections resistant to scab

Selections	Parentage
15.44-2-46	(Arnica x 15-2) x (Hindenburg x 15-2-32)
101.44-9-46	(Arnica x 15-2) x (Hindenburg x 13-1)
59.44-14-46	(Hindenburg x 15-2-33) x (Jubel x 15-2)
113.43-1-45	528-170 x (Jubel x 15-2)
113.43-8-45	528-170 x (Jubel x 15-2)

Selections resistant to late blight

73.43-44-45	Ac. 28.5 x 15-2-43
14.46-18-48	Chisago x 95-56
14.46-21-48	Chisago x 95-56
36.46-13-48	Minn. 23 x 95-56

Selections resistant to scab and late blight

26.46-2-48	Hindenburg x 80-7) x B61-3
32.45-10-47	Chisago x B61-3
-22-	Chisago x B61-3
43.46-6-47	B61-3 x (Jubel x 15-2)

Project Title: The development of disease-resistant varieties of potatoes.

Leaders: Carl J. Eide and F. A. Krantz.

Assistants: Charles E. Logsdon and H. D. Thurston.

Importance: Resistance to disease is not only desirable but essential in potato varieties. Many diseases, such as scab, can be controlled practically only by the use of resistant varieties. Until scab-resistant varieties with satisfactory horticultural qualities are available, this disease will continue to be a limiting factor in potato production in many places. Diseases like late blight and the virus diseases can be and are controlled by other methods, but disease resistance reduces the cost of control, and for that reason is highly desirable.

Object: The object of this phase of the program at Minnesota is to test breeding material and selections for resistance to disease. Scab and late blight are the principal diseases now being investigated. Limitations of time, facilities, and manpower have prevented any but very superficial testing for virus resistance, but this is being undertaken as rapidly as possible. The work involves such pathological problems as creating epidemic conditions for testing and a study of the variation in the pathogens involved.

Plan of Work: Breeding material and selections are tested under as severe epidemic conditions as possible. More detailed plans are given with the results below.

Location: University Farm, St. Paul, Minnesota; North Central Station, Grand Rapids, Minnesota; and Potato Research Farm, Castle Danger, Minnesota.

Results: Common Scab Resistance.
Two hundred forty 4-hill rows of selections and varieties were grown on heavily scab-infested soil at the North Central Station at Grand Rapids. Notes on prevalence and severity were taken on 232 of these. A single hill of susceptible variety was grown with each 4-hill row. In practically all cases this variety was as heavily scabbed as possible, with respect to both severity and prevalence.

Only those selections with a severity rating of two or less are saved as having commercially acceptable resistance. These also are those with the lowest degree of prevalence as judged by the area of the tuber scabbed. The association of prevalence and severity is illustrated by Minn. table 1.

Minn. table 1. Association of relative prevalence and severity of common scab on potato varieties and selections grown at North Central Station, Grand Rapids, Minnesota.

Prevalence 2/	Severity Rating 1/ 1	2	3	4	5	Total
T	7 3/	22	8	5	1	43
L	2	27	28	12	5	74
H	0	9	23	25	21	78
M	0	0	5	15	17	37
Total	9	58	64	57	44	232

1/ Numbers refer to pustule types: 1 = small and very superficial; 5 = pit scab.

2/ Area of tuber covered: T = Trace, L = Light, M = Moderate, H = Heavy

3/ Numbers refer to the number of selections falling into each prevalence and severity class.

Seedling reaction to late blight in the greenhouse

Twenty-one seedling families grown in flats or, in a few instances, as single plants in pots, were inoculated with a suspension of spores of Phytophthora infestans in the greenhouse. The total number of seedlings in each family ranged from 12 to 520, and the number of replicates inoculated at different times ranged from 1 to 6. The percentages of seedlings infected in different seedling families ranged from 12 to 100. Tubers were harvested from survivors and planted in the field. This is apparently a very effective way to eliminate susceptible material. It is faulty in that the exact pathogenic capabilities of the races involved was not known.

Field Reaction to late blight.

One hundred forty selections and varieties grown at Castle Danger, Minnesota, were inoculated with Phytophthora infestans by placing infected potted plants among the rows. In addition the plants were sprayed with a suspension of spores of the fungus on three occasions. Notes were taken three times by estimating percentage defoliation according to the method of Barratt and Horsfall.

When the final notes were taken 126 of the selections and varieties were free of blight. This included 104 Minnesota selections. Varieties such as Kennebec, Chenago, Ashworth, Hartford, Cortland, Virgil, Fillmore, Essex, and selections 96-56, and B61-3 were all completely free of blight also. Six selections, as well as varieties Waseca and Chisago, were 98 to 100 percent defoilated, whereas Sebago was 24 percent defoilated. The absence

of blight on some of the above varieties, some of which have been shown to be susceptible to certain races of P. infestans, indicates that these races were not among those used to inoculate the plants in the field. It is highly probable that many of the seedlings found resistant in this test would also be found susceptible to other races.

Tuber decay by late blight

Tubers of all varieties and selections found resistant in the field were inoculated by dipping in a spore suspension of Phytophthora infestans. They were inoculated three days after harvest, and half of them were wounded by scratching lightly with pins. Minn. table 2 shows that of the Minnesota selections that were found resistant to foliage blight, 80 percent remained free of tuber decay when inoculated without previous injury, whereas only 18 percent remained uninfected if injured. The same tendency is found in the other selections and varieties tested. It is apparent here, as has been demonstrated before, that varieties resistant to certain races of P. infestans in the field may have tubers susceptible to the same collection of races, especially if the tubers are slightly injured before inoculation.

Physiologic races and adaptation

One isolate used in greenhouse experiments infected Empire heavily, caused slight necrotic flecks on Chenango, and no symptoms at all on vigorous Kennebec plants. A few days after the appearance of the necrotic flecks on Chenango, some of these reached a size of about 6 mm. in diameter and bore a few sporangia. When Chenango was reinoculated with these sporangia, no infection resulted, and inoculum increased on potato slices resulted in flecks only. Thus no increase in virulence was noted on the plants inoculated. Repetitions of this experiment resulted in small lesions on Chenango, but no further sporulation. When older plants were used, the lesions on older leaves were larger, but there still was no sporulation.

When old plants of Kennebec were inoculated the senile leaves bore typical lesions, as there were on Chenago, However, sporulation occurred on Kennebec. These Sporangia were cultured and fungus was increased on sterilized peas and used to inoculate vigorous plants. Cobbler and Empire became infected, but Ac 395, T1-5, Kennecec, and Chenango were not.

These results tend to confirm those reported by Reddick, Mills, and Peterson regarding the behavior of the pathogen on senile plants. So far, no increase in virulence has been found, but this is very probably due to ignorance of details of the necessary techniques. Since Empire was heavily infected it is assumed that we probably have race D of Reddick, Mills, and Peterson. This culture lost virulence for all varieties when transferred frequently on lima bean agar, but was reisolated from infected plants.

Careful research was made for lesions on senile leaves on plants grown at Castle Danger, but only one such lesion was found, and on this there was no sporulation. A great majority of the selections and varieties in the test were still growing virorously at harvesttime, but it should still be possible that this phenomenon would occur on earlier varieties that start to mature before harvest.

Minn. table 2. Infection of tubers of potato varieties and selections inoculated by dipping in a suspension of Phytophthora infestans spores. 1950

Variety or selection	Not bruised before inoculation: In test	Percent tubers infected 1/: 0	20	25	40	50	60	75	80	100	Bruised before inoculation: In test	Percent tubers infected 1/: 0	20	25	40	50	60	75	80	100
	No.										No.									
Minn. Selections	101	80	1	17		1	1			1	102	18	3	13	1	15		23	3	26
Other Selections	17	12		3		2					17	2		3		2		4	1	5
96 - 56	7	5	1					1			7							1		6
B 61 - 3	1	1									1							1		
Chenango	1							1			1							1		
Ashworth	1	1									1					1				
Hartford	1							1			1									1
Cortland	1	1									1	1								
Virgil	1	1									1				1					
Filmore	1	1									1									1
Essex	1		1								1								1	
Kennebec	1	1									1									1

1/ Percentages are based on 4 or 5 inoculated tubers of each selection or variety.

MINNESOTA AGRICULTURAL EXTENSION SERVICE

O. C. Turnquist

Potato variety demonstration plots were conducted in Clay, North St. Louis, Lake of the Woods, and Freeborn counties in Minnesota in 1950. These counties represent a cross section of the potato-producing areas of the State. One-hundred-pound lots of seed of each variety were planted in double rows with equipment furnished by the cooperator. At harvesttime yield data were obtained from two of the plots. These data are presented in Turnquist tables 1 and 2.

Turnquist table No. 1 Yield of 20 potato varieties tested in North St. Louis County 1950 (Upland Soil)

Variety	Yield per Acre
	bu.
Essex	591
Bliss Triumph	576
Russet Rural	557
Red Warba	542
Houma	520
White Rose	503
Kennebec	498
Pontiac	496
B 61-3	474
Burbank	460
Katahdin	457
Waseca	435
Satapa	438
Chisago	436
Rural New Yorker	431
Russet Sebago	426
Irish Cobbler	397
Russet Burbank	356
Early Ohio	278

Turnquist table No. 2 Yield of 18 potato varieties tested in Freeborn County 1950 (Muck Soil)

Variety	Yield per acre		B size
	US No. 1	US No. 2	
	Bu.	Bu.	Bu.
Pontiac	739	91	197
Waseca	700	67	10
Stapa	699	60	104
Katahdin			

Continued Turnquist table No. 2.

Variety	Yield per acre		B size
	US No. 1	US No. 2	
	Bu.	Bu.	Bu.
C. S. 6316	679	64	160
B 61-3	641	86	64
Kennebec	570	67	133
Red Triumph	568	92	139
Ontario	500	157	43
Minn. 24, 43-6-45	500	87	70
Russet Rural	490	63	24
Chisago	488	80	170
Teton	447	117	58
Minn. 43	441	92	128
Cobbler	438	109	75
Sebago	427	40	40
Progress	416	109	145
Cobbler	358	49	124

Included in the tests was a numbered selection B 61-3, a mid-season variety with a combination of scab and late blight resistance. The tubers appeared to be round to oval and flat to fairly plump. On some occasions in the past this variety has been inclined to become rough but this characteristic was not too apparent in the tests this year. The tubers have a paper-white skin with an appearance of an artificially waxed potato. It appears to resist bruising and abrasion and holds up well in storage. No scab or late blight infection was observed on tubers of B 61-3.

In the Freeborn County plot on muck, selection C56316 was tested. This selection arose from a cross made by Schaal and Edmundson at Greeley, Colo. It is medium early in maturity, produces white oblong to slightly flattened tubers with shallow eyes and has good market and culinary quality. This selection did not show any signs of scab infection in this year's plots.

Kennebec continued to perform well on all plots. Although the vines were green until frost, the tubers set before those of Irish Cobbler. It has been observed that unless this variety is spaced closely or its vines are destroyed at the proper time many oversize tubers will result. Some scab infection was observed on tubers of Kennebec this year.

Essex appeared to be the highest yielding variety in the North St. Louis county plot with a yield of 591 bushels. It is interesting to note that the three lowest yielding varieties were Early Ohio, Russet Burbank, and Irish Cobbler.

On the muck, other outstanding varieties, in addition to B 61-3, 6316, and Kennebec, were Pontiac, Katahdin, Waseca, and Satapa.

MONTANA

M. M. Afanasiev

Testing potato varieties for their resistance to scab (Streptomyces scabies), yield, and the adaptability to Montana conditions, was started in 1949 and continued in 1950. These experiments were conducted in cooperation with the Botany Bacteriology Department and the Horticulture Department of the Montana Agricultural Experiment Station, Bozeman, Montana. Tests in 1950 were conducted at the following three locations in Montana:

(1) Montana Agricultural Experiment Station Farm, Bozeman, Montana.
(2) Northwestern Montana Branch Station, Creston, Montana.
(3) Eastern Montana Branch Station, Sidney, Montana.

The following potato varieties were obtained through the courtesy of Dr. F. J. Stevenson, U.S. Department of Agriculture, and from Mr. R. V. Akeley, U.S. Department of Agriculture, Presque Isle, Maine:

Cayuga	Kennebec	Pontiac
Chippewa	Madison	Sebago
Irish Cobbler	Marygold	Seneca
Erie	Mohawk	Sequoia
Green Mountain	Norkota	Teton
Houma	Ontario	1279-185
Katahdin	Pawnee	

All these varieties were grown at Bozema, but at Creston and Sidney only some selected varieties were planted.

The yield and some cultural notes for potatoes grown at Bozeman, Creston and Sidney are given in Mont. tables 1 and 2.

Mont. table 1. Potato variety trial Bozeman, 1950.

Variety	Total yield per acre	No. 1 Grade by count	No. 1 Grade by weight	Mean tuber wt.	Average specific gravity	Vine height
	cwt.	pct.	pct.	oz.		cm.
Warba	346	76.8	93.5	8.6	1.077	43
Waseca	215	71.1	92.5	7.8	1.074	37
Cobbler	349	63.1	84.2	7.1	1.075	42
Bliss Triumph	533	81.7	95.0	6.9	1.074	62
Progress	277	58.3	78.8	4.8	1.070	38
Chisago	360	75.2	92.6	9.6	1.072	47
Essex	467	57.1	83.0	4.3	1.068	75
Chippewa	450	75.8	93.3	6.3	1.068	60
Satapa	332	90.0	94.8	8.7	1.071	37
1276-185	304	52.8	80.2	4.7	1.077	37
Chenago	477	69.2	90.1	5.4	1.078	55

Mont. table 1 continued

Variety	Total yield per acre	No 1 Grade by count	No 1 Grade by weight	Mean tuber wt.	Average specific gravity	Vine height
	Cwt.	Pct.	Pct.	oz.		Cm.
Madison	349	82.6	95.4	8.7	1.087	53
Ashworth	481	88.4	97.8	8.5	1.071	62
Pawnee	381	79.4	94.6	6.2	1.077	37
Green Mt.	491	79.0	95.3	8.4	1.078	62
Mohawk	394	86.2	96.2	11.4	1.073	62
Katahdin	422	72.5	92.4	6.6	1.076	60
Virgil	460	62.1	84.7	6.1	1.072	65
Placid	429	69.5	87.4	6.1	1.071	62
Kennebec	581	75.0	90.5	8.7	1.077	80
Sebago	356	69.2	91.3	5.9	1.068	68
Norkota	235	70.6	96.2	5.7	1.072	42
Kasota	408	79.2	93.5	6.0	1.072	48
Houma	356	49.6	78.1	3.8	1.076	58
Erie	308	77.4	92.5	6.9	1.070	55
Teton	311	81.0	94.5	6.8	1.074	50
Marygold	356	79.4	90.0	8.1	1.073	48
Netted Gem	439	68.6	84.8	6.0	1.081	58
Canus	405	77.2	94.1	7.6	1.069	51
Ontario	346	71.2	90.0	6.6	1.071	58
Seneca	370	73.7	79.3	8.1	1.071	82
Cayuga	381	60.4	80.5	4.6	1.080	52
Sequoia	353	76.4	93.8	8.2	1.062	70
Pontiac	522	73.6	73.3	11.2	1.067	60
Means	401	71.5	89.6	6.9	1.073	55
LSD (1 %)	131				0.008	

All varieties planted May 17, and harvested September 21.

LSD means Least Significant Difference, or the amount necessary for statistical significance at odds of 99:1.

Specific Gravity is an indirect measure of quality. In general, the higher the specific gravity the better the quality.

Varieties are listed in approximate order of maturity.

Mont table 2. Potato variety trials at the Northwestern Montana Branch Station, Creston, and at the Eastern Montana Branch Station, Sidney, 1950.

Variety	Creston	Sidney		
	Total yield per acre	Total yield per acre	No. 1 grade by weight	Date of full bloom
	Cwt.	Cwt.	Pct.	
Waseca	248	255	80.8	8/15
Cobbler	267	261	76.8	8/8
Triumph	304	305	76.6	8/5
Chisago	273	261	80.3	8/4
Essex	323	355	81.9	8/6
Chippewa	304	355	86.4	8/2
1276-185	--	305	74.7	8/3
Pawnee	--	255	87.4	8/6
Green Mountain	317	379	74.8	8/7
Mohawk	--	311	83.3	8/6
Katahdin	230	236	77.6	7/29
Kennebec	273	398	82.2	8/8
Sebago	298	292	94.7	8/3
Kasota	279	336	79.5	8/5
Houma	305	305	82.8	8/5
Erie	248	243	79.5	8/4
Teton	311	361	84.2	8/6
Netted Gem	230	230	69.9	8/4
Ontario	286	261	83.5	8/8
Cayuga	242	230	50.7	8/4
Sequoia	323	323	83.9	8/6
Pontiac	354	392	84.5	8/5
Means	286	305	79.7	
LSD (1%)	75	118		

At Creston the plots were planted on May 24, and were harvested on September 28.

At Sidney the plots were planted on May 25, emergence was general on June 13, irrigation was given on July 25, and the harvest was on October 14.

In the pressnt discussion detailed cultural notes are given only for the potatoes grown at Bozeman, since these potatoes were graded for scab.

All potato varieties were planted at Bozeman on an experimental plot of the Horticulture Department on May 17, 1950. The seed was cut by hand and planted with an assorted feed Iron Age planter. Single-row plots 36 feet long and 42 inches between rows were used (0.00289 acre). Each variety was replicated three times with four exceptions. The plots were harvested September 21.

Scab readings were made only on No. 1 potato tubers grown in Bozeman, Mont. table 3 shows the average percentage of clean and healthy potatoes for all replications for each potato variety.

Mont. table 3. Potato varieties tested for resistance to scab grown in Bozeman, Montana, 1950.
No. 1. Potato tubers graded for scab --percentage basis 1/

Variety	Total		Degree of Disease					
	Healthy	Diseased	Common Scab			Deep Scab		
			Slight	Medium	Severe	Slight	Medium	Severe
	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
Ashworth	19.6	80.4	71.0	6.6	--	2.8	---	---
Bliss Triumph	29.9	70.1	65.6	2.7	--	1.8	---	---
Canus	21.0	79.0	67.0	10.6	--	1.4	---	---
Cayuga	65.7	34.3	34.3	--	--	--	---	---
Chenago	57.8	42.2	---	--	--	--	---	---
Chippewa	20.2	79.8	68.1	7.8	--	3.3	0.6	---
Chisago	7.7	92.3	76.5	12.2	2.8	0.8	---	---
Irish Cobbler	9.9	90.1	76.6	9.0	1.2	3.3	---	---
Erie	16.9	83.1	72.7	7.2	0.4	2.8	---	---
Essex	24.0	76.0	65.9	9.1	--	--	1.0	---
Gr. Mountain	16.3	83.7	78.4	4.7	--	0.6	---	---
"Holling"	22.9	77.1	67.4	4.7	--	4.4	0.6	---
Houma	24.5	75.5	66.0	2.0	0.6	5.7	1.2	---
Kasota	34.9	65.1	61.7	2.4	0.5	0.5	---	---
Katahdin	22.7	77.3	68.0	8.4	--	0.9	---	---
Kennebec	43.3	56.7	54.2	2.5	--	--	---	---
Madison	4.4	95.6	74.9	16.8	0.7	2.7	0.5	---
Marygold	32.9	67.1	58.3	1.7	--	7.1	---	---
Mohawk	13.0	87.0	66.5	2.9	--	17.6	---	---
Netted Gem	93.6	6.4	6.4	---	--	---	---	---
Norkota	16.1	83.9	61.8	9.8	2.0	6.6	3.7	---
Ontario	66.1	33.9	30.1	2.7	--	1.1	---	---
Pawnee	14.8	85.2	65.3	15.7	1.6	2.6	---	---
Placid	26.0	74.0	69.3	3.8	--	0.9	---	---
Pontiac	33.1	66.9	62.2	0.9	--	3.8	---	---
Progress	42.5	57.5	54.8	1.4	--	1.0	0.3	---
Satapa	27.0	73.0	69.0	3.1	--	0.9	---	---
Sebago	31.5	68.5	59.2	9.3	--	--	---	---
Seneca	83.8	16.2	15.9	0.3	--	--	---	---
Sequoia	11.8	88.2	73.6	8.4	--	6.2	---	---
Teton	13.2	86.8	68.4	15.8	0.2	2.4	---	---
Virgil	49.4	50.6	46.8	3.3	--	0.5	---	---
Warba	12.6	87.4	80.4	6.4	--	0.6	---	---
Waseca	26.3	73.7	68.2	3.3	0.6	0.4	1.2	---
1279-185	34.0	66.0	56.0	3.1	0.2	5.9	---	---

1/ Healthy - no scab.
Slight - not more than 2 percent of the surface covered with scab lesions.
Medium - 2 percent to 10 percent of the surface covered with scab lesions.
Severe - more than 10 percent of the surface covered with scab lesions.
Common scab-ruptured but not sunken; Deep scab--pitted.
Russet scab was disregarded in this grading.

In general there was a considerable amount of scab on practically all potato varieties, although the degree of scab in most cases was only slight. The common type of scab was the most prevalent. Deep type of scab occurred only in very slight amounts with the exception of variety Mohawk, which had a considerable amount. Potatoes were not graded for russet scab because tubers showed only slight infection with this type of scab.

The results of these tests indicated that two potato varieties showed a high degree of resistance to scab; Netted Gem 93.6 percent healthy, and Seneca 83.6 percent. In addition, the following varieties produced 50 percent or more of healthy potatoes: Ontario 66.1 percent, Cayuga 65.7 percent, and Chenango 57.8 percent.

All remaining varieties had more than 50 percent of their tubers infected with scab lesions.

These results show that there is quite a close correlation between those of 1949 and 1950.

These experiments will be continued in 1951.

NEBRASKA

H. O. Werner, Robert O'Keefe, Harold Chapman, and Roger Sandsted

---

The field work carried in the breeding program at the Nebraska station during the year 1950 was considerably more extensive than in former years. This was primarily for the purpose of locating segregates that would be scab resistant. For this purpose a larger number of seedlings than in previous years were tested for a second year in the field before discarding. The out-State testing or adaptation testing program was also increased. As a consequence of this expanding, the sorting and evaluation of the characteristics of the tubers produced has taken up a greater amount of time, so it has not been possible to study and summarize the data to the point generally attained at this time of the year (January 24). Consequently, very few aspects of this year's work have been closed up, and conclusions on many phases will have to be carried over to the annual report one year hence.

Commercial Aspect

The Progress potato has now been in extensive commercial production for two seasons in northwestern Nebraska. It is estimated that about 5,000 acres were planted with this variety in 1950. This season appears to have been extraordinarily favorable for potato growing and especially for this variety, because the temperatures in August and September averaged 5° to 7° below the long-time averages. The quality of the Triumph variety, the standard variety of irrigated sections in northwestern Nebraska, was more nearly typical of most recent seasons than was the 1949 crop. That means that there was considerable scab on the Triumphs this year, and that they cracked quite a bit at harvesttime. Under these conditions, the general result with the Progress is somewhat as follows: In these large field plantings Progress has produced relatively little scab and that has been relatively mild. Harvest cracks have been relatively minor and not frequent. As a consequence, the percentage of No. 1 potatoes is approximately 25 percent greater than with Triumph. The percentage of culls is very much smaller than with Triumph. Because of this difference in grade, and assuming that the yields of the two varieties are about the same, which appears to be a reasonable assumption, the returns per acre are considerably greater with Progress than with Triumph. Conservative estimates arrived at by various methods of figuring have placed the monetary value due to this improved quality at no less than a quarter million dollars for the present season. Progress potatoes are finding a place for themselves on the market. Very commonly, after they are once put on sale in any market, they are demanded thereafter. In a comparative sales test in six stores in Lincoln, Nebr., in November and December of 1950, No. 1 Progress potatoes sold at the rate of about 2 of Progress to 1 of Triumph. One factor in this was the preference of the customers for the Progress because of the better appearance, there being fewer mechanical injuries and air checks after the potatoes were handled through the trade channels and exposed in the display racks in the stores. They also had recognized some superiority in cooking quality. The Progress, as grown this past year, is very satisfactory for baking, much more so than the Triumph.

The two major shortcomings of the Progress variety are its propensity to growth cracks if moisture conditions are variable during the time that the tubers are developing and small tubers which may result from an excessive set. It appears now that the growth cracking can be avoided by keeping the soil constantly moist in the top 18 inches. The tuber size proposition is largely a matter of fertility and irrigation. If both of these are adequate, the tuber size will not be a serious commercial problem. There will then be very few small potatoes. If either of these are likely to be inadequate, it is advisable to plant smaller quanties of seed per acre of Progress than has been the practice with Triumph.

There will undoubtedly be great expansion in the production of Progress potatoes in northwestern Nebraska during the 1951 season. We are somewhat concerned about this because of the fact that it is a variety that requires special care for the production of a satisfactory crop, and also because we realize that we are not often likely to have such a favorable season for this variety. As a matter of fact, a season as favorable as 1950 was for tuber production does not occur more than about once in 7 to 10 years in northwestern Nebraska. An extensive educational campaign is being launched to inform growers concerning the best procedures to use in growing the Progress variety and to emphasize the imperativeness of doing the job properly.

White Cloud potatoes are attracting more attention than in recent years. Very favorable results were attained with this variety in North Carolina and Kansas during the 1950 season. Undoubtedly, considerable commercial production with it would be taking place in those areas this year if the seed potatoes were available. This variety continues to attract attention because of the unusual uniformity in shape and size of the tubers and the good culinary characteristics. Unfortunately, however, the cooked potatoes sometimes do lack a bright white color, and the variety is somewhat subject to hollow-heart under conditions that are relatively favorable for that physiological difficulty. It is doubtful whether this variety will attain much volume in commercial production in western Nebraska, but it may be grown commercially as a white potato in central Nebraska where it is enjoying considerable popularity with some growers.

Advance Lines - Pre-introduction Stage

Two red selections selected from a cross between Triumph and Nebraska 49.40-3 and a mid-season white segregate are being increased with a view to pre-introductory commercial plantings. The red selections are likely to be of value in central Nebraska for early potato production to replace the Red Warba. They both produce potatoes of smoother type with a higher percentage of No. 1 tubers than does the Red Warba. The culinary quality is likely to be better. They possess no scab resistance. The white variety has been showing up very well both in central and western Nebraska as a very productive variety with good type white tubers. The vines are quite rugged and have shown great ability to recover after severe hail damage. The vines also appear to possess some resistance to early blight. The table quality is equal or better than that of the Triumph, but perhaps, inferior to that of Progress and White Cloud..

Crossing Program

We have obtained one of the objectives in the program; that is, the procurement of red-skin tubers of good type and of mid-or early-season production. We are now at the stage where we are in the first and second cycles of testing seedlings of crosses of these red clones with some of the highly scab-resistant lines. We are, in many instances, making the third cycle of crosses. Out of this material we hope to get a large number of segregates that will possess red color, scab resistance, proper season, and culinary quality. We think that they must at least have all four of these characteristics.

Testing for Scab Resistance

Efforts are still being made to determine scab susceptibility in the greenhouse by inoculating the sand culture beds, where the seedling tubers are produced, with a culture made from scabby tissue scraped off of a large number of potatoes showing various types of scab. We cannot, at this stage, tell what success we are attaining with this method. We were unsuccessful in getting satisfactory inoculation during the previous winters when pure cultures were used.

Three locations were devoted to testing clones for scab with from 1 to 4 small plants of each clone. About 500 clones that were 3 or more years removed from the seedling generation were tested in quadruplicate plats. In all of these tests each row of trial potatoes was planted between rows of Progress and Triumph, which alternated across the entire field. The replications of these plantings were included in the testing program, but on the basis of the field observations and a rather careful studying of the notes, it appears that the uniformity in the various replicates, especially when considered in relation to the adjacent Triumph lots, is so great as to call for rather careful analysis of the data before proceeding with a recommendation of such extensive replication. It might be better to test more segregates from the families concerned than to make a replicated test of a few selected segregates.

In addition to the replicated tests referred to, approximately 4,000 segregates, representing that many hills from the second class of selections of the previous year's seedling plot, were planted in the field which was thoroughly infected with the scab organism. Approximately 125 lines showing high resistance and good tuber type were saved out of this number. A similar group of tubers has been saved from the 1950 seedling plot for testing in 1951. By this method it is thought that we will find more lots of high resistance than if the initial selection from the seedling family is made purely on the basis of market type.

The general results to date in the Nebraska program is that there is on hand approximately 400 clones, more than half of which are red tubers, which show considerably greater resistance to scab than does the Triumph. Some of these appear to show a very high degree of resistance. We are endeavoring to test these lines very carefully for the purpose of getting parents that will be superior for our purpose to those that are now available.

Adaptation Tests

The replicated scab tests referred to in the previous section serve to some degree as adaptation tests under irrigation. In addition to that, all clones selected for any purpose whatsoever are grown on dryland for the purpose of increasing the seed stock and maintaining it virus free and also for the purpose of determining its adaptability to dryland conditions in western Nebraska. In addition to that, some 250 clones were planted as an early crop in central Nebraska at the North Platte Experiment Station in 1950. A number of these clones produced tubers superior to any of the commercial varieties. We, however, discount their ultimate suitability for that region because of the exceptionally cool summer. The climatic conditions in central Nebraska during late July and August were more nearly typical of those that usually prevail in northwestern Nebraska than of the weather in central Nebraska.

The extensive out-State testing program was continued with approximately a dozen named varieties and an equal number of advanced seedlings. The more promising of each of these groups were planted in replicated 20-hill plats. Seven of these tests were in central Nebraska, 4 were on dryland in northwestern Nebraska. and 8 were located or irrigated land in northwestern Nebraska. The results from these tests are dealt with more fully in a separate section of this report.

Determination of Wound Healing Ability of Potato Tubers

Some difficulties encountered by some commercial producers in getting good stands with the Progress variety led us to investigate the wound healing ability of the tubers of this variety. Although this variety will heal its wounds very satisfactorily if properly handled, it does appear that it is more exacting concerning the environmental conditions. In other words, when very satisfactory healing occurs under a given set of conditions with varieties like Triumph, many seed pieces of Progress may not heal satisfactorily. Whether this is due to incompleteness of the periderm development or to a greater susceptibility to tuber rots has not yet been determined.

An effort is being made to develop some test - even though it might be quite empirical - that will be more rapid than the classical paraffin method for making sections for microscope study. Extensive studies with a large number of lots during the past spring raises the hope that a good idea concerning the wound healing ability of a line of potatoes can be obtained by measuring the rate of weight loss from standardized cut surfaces held under controlled conditions. Further work along that line is contemplated for the current season.

An extensive test was conducted in the summer of 1950 to determine the influence of two disinfectant treatments and four methods of pre-planting treatment of seed potatoes upon the survival of the cut seed pieces and the sprout development when the tubers were planted. This was conducted with both the Progress and Triumph varieties. Under the most favorable conditions the seed-piece survival and sprout growth were almost as good with Progress as with Triumph. However, as soon as conditions were provided which brought about

some desiccation of the seed pieces, the Progress pieces seemed to suffer more than those of the Triumph. Disinfecting the surfaces with chlorine containing disinfectants did not appear to be any more advantageous than the check under the various holding conditions that were used.

Culinary Tests

A cooking test conducted with seven varieties grown at two places with seven individuals judging each of these lots of potatoes at five different cooking times resulted in concise evaluation of these lots. The lots tested were the three advanced lines that were contemplated for introduction in comparison with the Triumph, Progress, Menominee, and one selection that had been looked upon favorably for introduction. The three advance lines all were given ratings about on par with the Triumph, but not quite so good as those with White Cloud and Progress. One other segregate is being dropped because of the poor culinary quality. It, however, possesses a sufficient number of other characteristics which are superior to warrant its further use in the crossing program. The results with Menominee were very unsatisfactory, these tubers usually being too immature under our conditions.

In conjunction with the Home Economics Department, preliminary work is being done in setting up a program for testing the advance seedlings, not only with regard to their culinary value for steaming, but also for other uses such as for deep fat frying and for baking.

Specific Gravity Determination

Samples from all clones grown in the plats at Alliance, Scottsbluff, and North Platte are tested as to their spedific gravity using the gravimetric method. The specific gravity is also determined from samples of small lots in about half of the out-State testing adaptation plats and in all increase plats in the advance seedlings.

The estimate of the interior color of the tubers is recorded for the tubers of each clone. These estimates are made in the field at harvest-time and in the winter when the potatoes are cut for planting the following spring. The estimates on the basis of five classes of whiteness and one intermediate, which might be classified as yellow-white, and three classes of yellow color. There appears to be a very close correlation between the degree of whiteness of the tuber interior and the specific gravity and cooking quality. Although some lots which are not very white do cook quite well and have quite high specific gravity, lots with very poor interior color appear to be uniformly inferior in cooking quality and usually are of very low specific gravity. That tentative conclusion is the basis for discarding all lines that have tubers of very inferior interior color unless they possess several characters that are relatively scarce in other lines in the program.

Heat and Drouth Resistance

Projects are under way along three general lines to develop methods for determining the heat and/or drouth endurance of plants of any clones that might be selected. A study covering the seasons of 1949 and 1950 seems to indicate that on a dryland soil receiving relatively little rainfall during the growing season, all varieties, regardless of their vegetative characters, extract water at about the same rate for the first 5 or 6 weeks of the vegetative period. After that the rate of water removal depends upon the physiological health of the plant. As senility sets in the earlier varieties will, of course, remove relatively little water from the greater depths, but the later varieties with vigorous foliage can extract water to a depth of 3, 4, or even 5 feet and maintain relatively good growth. As a consequence, the tuber production per inch of water taken out of the soil has been found to be strikingly similar with seven varieties of very dissimilar vegetative characteristics.

Another line of endeavor is for the purpose of determining the relationship between morphological characteristics and drouth endurance or survival of plants under drouthy conditions. This is being approached by careful morphological classifications and evaluation of the damage or resistance to the effects of very high temperatures under drouthy conditions. These data are currently being evaluated. Another method being used is to measure the water retention ability of plants of different varieties when they are served from their roots. This line of endeavor appears to be very promising. Certain clonal lines that show considerable ability in the field to survive protracted periods of heat and drouth appear to be able to retain water in their tissues for a longer period of time than do those that show more effect of the heat in the field.

Another line of endeavor that has been found to be quite valuable in empirically evaluating the photosynthetic period with cotton in Africa is being adapted to potatoes. This method is based on the principle of measuring the rate of turgidity loss of leaf sections that are cut out of the leaf at different times of the day. The work done to date seems to indicate that the retention of high turgidity varies by varieties roughly in proportion to their ability to survive under the desiccating conditions that sometimes prevail with dryland culture.

Flea Beetle Resistance

Observations continued during the past year show that two lines that have heretofore shown high resistance to tuber damage by flea beetle larvae continue to have this resistance during the additional years of testing. These two lines are the Doe Bay Red and a Nebraska selection, 8.38-8. During the past season, seedling populations of tubers were produced in the field with each of these lines as one of the parents. These will be evaluated as to their flea beetle resistance during the next year or two.

Performance of New Potato Varieties

In Increase and Adaptation Plats in Nebraska

A number of the new varieties, that is, those which have emanated from potato-breeding programs in recent years, where grown either in increase plats on the Experiment Stations at three places in the western half of Nebraska or in the adaptation tests which were grown at locations ranging from approximately 900 feet above sea level near Omaha, in the eastern edge of the State, to 5300 feet above sea level on dryland near the Wyoming line. These adaptation tests were located on both dryland and irrigated land in the various portions of the State. The data from these tests are, of course, too voluminous to come within the space limitations that can be expected in a report of this kind. We shall therefore endeavor merely to report the more distinctive characteristics, either favorable or unfavorable, that were observed this past year with each of these varieties.

In considering this information it will be well to remember that in central Nebraska, where the early potato crop is grown, the temperature conditions more nearly approached those of an average season in western Nebraska than is usually the case; the average temperatures at most of these central Nebraska places were 4° to 8° below the long-time averages throughout the latter part of July and much of August, when the potato tonnage was being produced. Likewise, it must be realized that in western Nebraska the weather, with regard to temperature at least, was more nearly like that of the Red River Valley or of northern Maine, because of temperatures that were in the neighborhood of 6° to 7° below average during August and September. In western Nebraska early blight was common in some of the low-lying fields in the irrigated areas, and flea beetles inflicted unusually severe damage where the spraying job was not complete or satisfactory. The general level of quality, as measured by specific gravity was lower than usual with most varieties in all parts of the State. Several plats had been in some very severe hail storms, so we were able to observe both the amount of damage and the extent of recovery differentiation between varieties.

It would probably be simplest to compare the various varieties with the standard varieties grown in the locality, as well as to enumerate the characteristics observed with the varieties. In central and eastern Nebraska the Red Warba and the Irish Cobbler are still the most common varieties. The total yields of these varieties were satisfactory, but the percentage of No. 1 potatoes was relatively low because of a very high percentage of rough potatoes, many of which had hollow-heart. The specific gravity of Irish Cobbler was generally among the highest in any test plat, but that of the Red Warba was mediocre or low. In western Nebraska the standard variety for many years has been the Triumph variety. This year it suffered about the usual amount of damage from scab and harvest-time cracks. These two defects caused a very serious loss in grade quality of the potatoes. The Progress variety is coming into prominence in western Nebraska and will be discussed in proper order in this account of the varieties.

Cayuga in this cool season gave a very distinctive performance in the western part of the State where it netted one of the highest yields of No. 1 potatoes, due to practically complete freedom from scab and rough potatoes. The specific gravity was usually the highest or close to the highest in each trial. The dryland yield of No. 1 potatoes was among the highest produced. The vines survived the hail storms relatively well and showed rather quick recovery. In all yields in which Cayuga has been tested in Nebraska, the tubers have always had very high specific gravity. It does not seem likely that the yield of No. 1 potatoes will be as satisfactory in most of the seasons that are usually warmer. It was commercially unsatisfactory in the central and eastern part of the State.

Chippewa yields of No. 1 potatoes were medium to high in western Nebraska, but the incidence of scab was v ery high and the specific gravity of the tubers was below that of Triumph.

Chisago in central and eastern Nebraska fell behind Red Warba and Cobbler in total yield, but usually exceeded both of them in yield of No. 1 potatoes. This was chiefly due to a lower percentage of scabby potatoes and small size potatoes. Although the market appearance of the potatoes was somewhat better than that of Irish Cobbler, the potatoes are still considerably rougher than is desirable. The specific gravity of tubers was higher than that of Red Warba, but usually lower than that of Irish Cobbler. The percentage of large potatoes with this variety is quite a distinctive feature. In western Nebraska the total yield of No. 1 potatoes was greater than that for Triumph, but the market appearance was less desirable for most white varieties, largely because of the deep eyes. Their specific gravity was slightly higher than that of Triumph.

Essex was among the most productive in the early-crop tests. The percentage of No. 1 potatoes was very high and the specific gravity of the tubers was usually on par with that of Red Warba tubers. In western Nebraska yields were good, and scab was less frequent than with Triumph, but the variety could hardly be considered as having very high scab resistance. The specific gravity of tubers was relatively low in the western plots. The variety is probably too late for the high altitude areas.

Kasota produced relatively high yields but because of high percentage of shallow-type scab, the percentage and yield of No. 1 potatoes were relatively low. The specific gravity of the tubers was usually slightly superior to that of Triumph. The variety was not tested in central and eastern Nebraska where it has heretofore been found to be quite unsuitable. The excellent type of this variety was again apparent as an outstanding characteristic.

Katahdin produced satisfactory yields of relatively good quality potatoes. The percentage of scab was almost as high as that for Triumph. Where scab is not serious, this is still one of the most satisfactory of the late white varieties. It is,however, difficult to harvest this variety in the bright, dry air of western Nebraska without encountering a great deal of browning of all scuffed areas.

Kennebec this year produced the best tubers of any that we have yet seen in western or central Nebraska with this variety. However, they are still somewhat tapering at the stem end, and many of them are still somewhat sunken on the dorsal and ventral sides near the stem end. The percentage of scabby potatoes was relatively low, but the percentage of No. 1 potatoes in irrigated plats was still undesirably low because of the very high percentage of poor type tubers that had to be thrown out. Sun-greening was also a very common defect. Unfortunately, this variety does not seem satisfactory for commercial production in western Nebraska. In central Nebraska it is being watched with interest. There the yields have been fairly satisfactory, and some growers are hoping that they can grow good type tubers of this variety. Their interest has been aroused primarily because of the blight resistance and the good shipping quality.

LaSoda produced relatively low yields of attractive red potatoes. The percentage and severity of scab were comparable to those of Triumph. The tubers were generally of good type with a tendency of being over-size. All things considered, it is about on a par with Triumph.

Marygold is perhaps to be looked upon chiefly as a novelty, which has been very productive in western Nebraska. The tubers are usually smooth, but tend to be small and almost as susceptible to scab as the Triumph, with a specific gravity average almost identical with that of Triumph.

Menominee appears to be too late for any of the areas in Nebraska. The percentage of scab is generally quite low, and the tubers are large. However, they are so immature that their cooking quality is too low to be acceptable. As a general rule, the percentage of No. 1 potatoes is somewhat higher than that for Ontario. The production of this variety is not being encouraged in Nebraska.

Mohawk tubers of excellent quality as to market grade have been grown throughout the last three seasons, both on dryland and with irrigation in western Nebraska. The limiting factor with it is the relatively high percentage of severe scab. The specific gravity is generally high, but not as high as one would have been led to expect in view of the reputation that it has enjoyed in the East. Under irrigation the specific gravity is usually slightly lower than that of Cayuga. One of the most interesting things of the past season was the very high yield of excellent type potatoes of unusually high specific gravity that were produced by Mohawk on dryland at an altitude of 4,000 feet.

Ontario usually has the highest rating in our tests with regard to freedom from scab. The percentage of scabby tubers is very low, and the type of scab is a very mild type that does not do an appreciable amount of damage to the market appearance of the potatoes. However, the variety is so late that the tuber type is generally very unsatisfactory and many of the potatoes are unusually rough and sun-greened. In addition to that, the specific gravity of the tubers is usually lower than that for Triumph. In warm seasons, that is, seasons that are warmer than this past year was, the performance of this variety is quite unsatisfactory.

Pawnee still appears to be the variety best capable of producing excellent type early potatoes. If scab is not prevalent in an area, the yield and percentage of Pawnee potatoes are usually sufficiently high to make it commercially very desirable, due mostly to the fine appearance of the tubers. The specific gravity is generally close to that of Irish Cobbler. When fusarium wilt is present, this variety will generally show a high percentage of infected plants.

Red Pontiac has come into commercial production in the irrigated areas in western Nebraska on a relatively large scale during the last 2 years. As in other parts of the country, the total yield of this variety is among the highest. In our tests, the percentage of No. 1 potatoes has been relatively high and scab has usually been much less prevalent than with the Triumph. The chief handicaps with this variety have been the tendency to produce many potatoes of excessively large and unmarketable size and a propensity for the tubers to become somewhat rough as they become larger, and some of them showing hollow-heart. In addition,the specific gravity of the tubers is generally quite low, so that the cooking quality is definitely inferior.

Progress has been discussed in the earlier part of this report. It seems to be filling a very important demand in northwestern Nebraska at the present time. The market appearance of the potatoes is generally better than that of Triumph, the potatoes hold up better during trade channels, and retain an attractive appearance for a longer time when displayed in retail stores. The total yield is quite similar to that for Triumph, but the yield of No. 1 potatoes is invariably higher because of the relatively low percentage of scab with Progress, most of which is of the mild type, and the very low percentage of mechanical injury. These advantages are, to some extent, nullified by the production of a high percentage of growth-cracked potatoes if irrigation is irregular. When the soil has been kept moist constantly throughout the tuber development period, the percentage of rough tubers is relatively small. Under these conditions the yields will be sufficiently large that the numerous tubers that are set on each plant will develop into medium-size tubers, thus eliminating the other disadvantage of many small tubers. This variety will replace a large quantity of the Triumph acreage in northwestern Nebraska. The culinary quality is superior to that of Triumph. If stored properly, Progress potatoes are very satisfactory for baking purposes. This variety is not at all suited to central and eastern Nebraska.

Satapa has usually produced a higher percentage of No. 1 potatoes and a higher yield of No. 1 potatoes in central and eastern Nebraska than the Red Warba. This has been due, usually, to a slightly lower percentage of scabby potatoes and a distinctively lower percentage of rough potatoes. The specific gravity is generally on a par with Red Warba. One of the most serious defects with this variety is its tendency to develop hollow potatoes, and when growing conditions are somewhat irregular many of the potatoes may have large objectionable growth cracks. If the color of the potatoes is acceptable on the market, this variety might be suitable for central Nebraska. In western Nebraska, scab was extremely severe in a number of the trial plats and the percentage of No. 1 potatoes was relatively low, due to both scab and growth cracking. It does not seem desirable for that part of the State.

Sebago yields are quite high, but the percentage of No. 1 potatoes is frequently low because of scab and rough tubers. The russet mutation is relatively free of scab on most soils, but the tubers are frequently so immature that the russeting is only poorly developed and the general quality of the tubers is inferior. Consequently, both of these types of Sebago are considered of dubious value in western Nebraska and of no value at all in eastern Nebraska.

Seneca may warrant further testing because of the high percentage of No 1 potatoes produced by it and the low incidence of scab. The specific gravity of these tubers has been relatively high. Sun greening is a serious difficulty with this variety.

Snowdrift was grown for the first time in our increase plats. On the dryland farm it produced a relatively high percentage of No 1 potatoes with relatively little scab and high specific gravity, but of relatively small size. Under irrigation the percentage of No. 1 potatoes was quite low, and although the yield was very high, it is dubious whether this variety will be suitable to our conditions because of the very high percentage of very scabby potatoes.

Waseca usually produced about the same yield of No. 1 potatoes as the Red Warba or slightly more. The percentage of No. 1 potatoes was usually slightly higher than that for Red Warba, due to a lower percentage of rough potatoes and sometimes to a lower percentage of scab. The specific gravity of Weseca potatoes was usually lower than that of the Red Warba. For northwestern Nebraska, Waseca does not seem worth considering because the color of the tubers is inferior to that of either Progress, Pontiac, or Triumph and the percentage of scabby and rough potatoes is very high.

Yampa is on the borderline of suitability for central Nebraska. In western Nebraska it has been found to have a very satisfactory degree of scab resistance, and the tuber type has frequently been very good. However, it does not seem a safe variety for commercial production in western Nebraska except in the hands of an expert, because of the great propensity to produce a very serious amount of growth-cracked tubers and also many hollow-heart tubers. Another serious difficulty is the very high percentage of sun-green tubers. The specific gravity of Yampa tubers is generally quite high.

NEW HAMPSHIRE

Paul T. Blood

The growing season at Durham was very dry. There was no rain of any consequence from June 1 to August 19.

The test plots were grown on land that had been cropped with potatoes in 1948 and 1949. Twenty-three hundred pounds of 5-10-10 fertilizer and 15 tons of manure were applied. The potatoes were planted May 12. The data for the variety tests are given in New Hampshire table 1.

New Hampshire table 1. Yield and specific gravity data of a number of potato varieties tested at Durham, New Hampshire, in 1950.

Variety	Yield per acre		Variety	Quality 1/ ratings
	U.S. #1	U.S. #2		
	Bu.	Bu.		
Kennebec	554	23	Cobbler	79
Green Mountain	492	35	Green Mountain	75
B73-10	479	28	Pawnee	75
Katahdin	479	21	B61-3	73.3
Essex	469	29	Mohawk	72.0
Chippewa	461	44	Russet	71.6
Sebago	461	42	B73-10	71.2
Yampa	454	38	B76-43	71.2
Houma	451	44	Madison	70.6
Ontario	444	104	Yampa	70.3
Russet	433	50	Fillmore	69.1
Virgil	414	43	Ashworth	68.8
B61-3	413	80	Houma	68.4
Madison	328	23	Kennebec	68.0
Cortland	312	30	Sebago	64.7
Pawnee	286	68	Chippewa	64.6
Pungo	279	32	Katahdin	64
Ashworth	276	22	Virgil	63.2
Cobbler	273	68	Essex	59.9
Mohawk	264	13	Ontario	58.7
Fillmore	218	31	Cortland	57.3

1/ The quality ratings are the specific gravities of the tubers with the 1.0 omitted. The rating for Cobbler, for example, when written in full would be 1.079.

Although there was some leaf roll in the Kennebec it yielded the highest of any variety.

B73-10 looked promising. It yielded about the same as Green Mountain, Katahdin, Essex, and a number of others.

Pungo (B76-43) and Mohawk were relatively low in yield but there was considerable rugose mosaic in these varieties. The specific gravity ratings were all low but the Green Mountains with a rating of 75 were much higher in cooking quality than we thought a 75-quality sample could cook. The Kennebec was about the same in cooking quality as the Mountains. This is the first time we have had to question the specific gravity method for determining quality.

We had 10 demonstration plots of Kennebec in the different counties, and every grower who had the stock liked it very much and wants to get more seed. One grower got 820 bushels per acre with one irrigation, in spite of the fact that there was some leaf roll in the plot. The specific gravity of Kennebec from this particular grower was 75.3 as compared with 75.8 for Mohawk grown under the same conditions.

NEW JERSEY

John C. Campbell

Forty-three different lots of seed, representing 28 varieties and 8 selections of varieties from 8 States and the U.S.D.A. were tested on at least 1 of 3 farms in central Jersey, and 6 of these varieties were tested on 4 additional farms. The 3 large tests were conducted on the farms of Spencer Perrine and Marvin Hulick of Cranbury and Oscar Ketchum of Freehold. The yield data for these tests are given in New Jersey table 1.

The variety producing the highest yield was the Chippewa #46 from Starks Farms, Wis., which produced the record yield of 909 bushels per acre, 99% of which, or approximately 902 bushels, were U. S. No. 1. This yield was produced in the test on the Marvin Hulick farm at Cranbury. The highest average yield of 642 bushels from these 3 farms was also produced by Chippewa #46 followed by Chippewa #20 with 584 bushels; Essex from the New York Cooperative Seed Growers, 583 bushels; Katahdin from Leland Smith, Maine, 578 bushels; and Kennebec from the Maine State Seed Board, 573 bushels. Most of the varieties produced very high yields on all 3 farms; in fact, the average yield of the 28 lots on the Hulick farm was 604 bushels of U. S. No. 1, the average for the 41 lots on the Perrine farm was 642 bushels and 380 bushels average for the 32 varieties on the Ketchum farm. The potatoes on the Hulick farm were irrigated 3 times.

Although the four other tests conducted on the farms of Arthur Applegate, Robbinsville, Robert Rozel, Windsor, Orville Dey, Cranbury, and Mount Hutchinson, Allentown, were not large in size they give important additional information on the yielding ability of six varieties. The varieties tested and average U. S. No. 1 yields produced were Kennebec 428 bushels; Essex 499; Ontario 450; Teton 398; Mohawk 368; and Pawnee 268 bushels per acre, respectively. Yields of standard varieties were obtained from two of these farms, and Kennebec and Ontario outyielded both Katahdin and Chippewa on one farm, and all but the Pawnee outyielded Katahdin on the other farm.

Quality

To obtain some information on the relative cooking quality of the various varieties we obtained the specific gravity of each lot from the three large tests and also conducted cooking tests of all lots. This work was done with the cooperation of members of the Food Technology Department, and members of the Entomology and Plant Pathology Department assisted on the testing panels. The specific gravity data are given in New Jersey table 2.

The specific gravity was determined by floating uniform-size potatoes in various concentrations of salt solution, and the cooking quality was determined by cooking the unpeeled potatoes in pressure saucepans at 15-pound pressure for 15 minutes, after which a tasting panel of 10 to 14 persons recorded their opinion of quality on a score card. Color, texture (soggy or mealy), flavor, and sloughing were used as the criteria for quality. Highest specific gravities were found in the Green Mountain, Mohawk, Cobbler, Russet Rural, and Kennebec, in the order named. The one sample of the Madison variety also had a high specific gravity. Samples rated mealiest and most pleasing in the cooking tests were Cobbler,

Green Mountain, Kennebec, Mohawk, Essex, Pungo, Madison, and even some Katahdins and Chips were rated good. Sebago and Ontario were generally soggy, and most of the Chippewas, Katahdins, and other varieties were inferior in cooking quality on one or more points.

These results indicate that in general Kennebec and Essex are well adapted to central Jersey growing conditions. It should be pointed out, however, that Kennebecs may produce large hollow tubers if spaced more than 11 inches in the row or fertilized too heavily. Essex needs plenty of water to size up and heavy set it usually makes. Teton does fairly well under most conditions but is superior to Katahdin only in regard to its ring rot resistance. Madison looks good from results of one trial. Pungo also has some promise as an early-maturing variety. Russet Rural, Russet Burbank, Waseca, and Satapa are all highly susceptible to late blight, and the Russets produce a small percentage of U.S. No. 1. Sebago and Russet Sebago produce erratic yields and are generally soggy in texture. Ontario produces too many B's, the tubers develop on long stolons, often chain fashion, and table quality is poor. Mohawk has high table and market quality but often produces relatively low yields when compared with Katahdin but will most always produce yields equal to Green Mountain. Pawnee, although having excellent table quality, usually produces low yields making it unprofitable to grow. Ashworth must be tried further to indicate its potential value.

N.J. table 1. Yield data for varieties and seedlings grown on the farms of Spencer Perrine and Marvin Hulick of Cranbury and Oscar Ketchum of Freehold in 1950.

Variety	Source	Yield per acre U. S. No. 1 and location						Ave. yield U.S.#1
		Cranbury 1/ Spencer Perrine Farm		Cranbury 2/ Marvin Hulick Farm		Freehold 3/ Ketchum Bros. Farm		
		Bu.	Pct.	Bu.	Pct.	Bu.	Pct.	Bu.
I. Cobbler # 60	Starks Farms, Wis.	481	95	621	97	372	89	491
I. " #29	do	470	92	612	98	343	89	475
I. "	Edwin Parkhurst Maine	455	94	629	94	345	89	476
I. "	Frank Harris, N. J.	420	92	568	94	483	93	490
Chippewa #20	Starks Farms, Wis.	611	94	745	97	397	89	584
" #46	do	571	97	902	99	454	95	642
"	Me. State Seed Bd.	594	97	523	93	356	87	476
"	Jeff. Baldwin, Minn.	549	98	---	--	361	86	455
" #1	Starks Farms, Wis.	531	97	613	97	309	89	485
" #9	do	497	92	653	95	512	93	554
Katahdin #49	do	536	99	585	98	366	94	496
"	Leland Smith, Me.	496	97	723	97	517	97	579
" #50	Starks Farms, Wis.	464	89	619	98	424	85	502
Katahdin	Frank Harris, N. J.	417	95	572	94	411	95	467
"	Vermont	---	--	---	--	379	95	---
Kennebec	Me. State Seed Bd.	610	96	627	97	481	91	573
Essex	N.Y. Coop Seed Grs.	576	89	746	94	426	92	583
Ontario	Starks Farms, Wis.	513	86	711	95	345	77	523
Sebago	Edwin Parkhurst, Maine	495	95	630	92	401	94	509
Teton	Barnett Bros. Pa.	468	89	679	97	432	85	527
Ontario	Frank Harris, N. J.	439	85	578	87	367	85	461
Gr. Mt.	Edwin Parkhurst	458	88	725	98	335	83	506
Satapa	Frank Harris, N. J.	444	93	536	95	440	88	472
Ashworth	N.Y. Coop. Seed Grs.	443	97	---	--	335	91	389

1/ Planted 4/17.50, harvested after killing vines with chemicals 9/29/50 (2200 # 4-12-8 fert. per acre) Ave. of 3 replications.

2/ Planted 4/12/50, harvested 9/20/50, irrigated 3 times (2,000 # 5-10-10 per acre) One plot only.

3/ Planted 5/8/50, harvested 9/25/50 (2,300 # 4-12-8 fert. per acre). One plot only.

N. J. table 1, continued

Variety	Source	Yield per acre U.S. No. 1 and location						Ave. yield U.S.#1
		Carmbury 1/ Spencer Perrine Farm		Cranbury 2/ Marvin Hulick Farm		Freehold 3/ Ketchum Bros. Farm		
		Bu.	Pct.	Bu.	Pct.	Bu.	Pct.	Bu.
Mohawk	NY Coop. Seed Grs.	423	98	510	97	392	91	442
Sebago	Starks Farms, Wis.	421	92					
Russet Sebago	Red Dot Farms, Wis.	410	92	538	92	302	90	417
Russet Rural	Starks Farms, Wis.	362	92	472	96	343	88	392
Mohawk	Frank Shaw, Maine	332	95	538	97	306	94	392
Russet Burbank	Starks Farms, Wis.	246	71					
Waseca	Frank Harris, N.J.	209	81	293	87	291	65	264
Pawnee	do	201	71	498	93	166	68	288
USDA sdlg.	Jeff Baldwin, Minn.	448	87	470	91	380	82	433
Madison	N.Y. Coop Seed Grs.					379	88	
B76-43 (Pungo)	USDA, Maine	523	92					
BN-5	Barnett Bros.,Pa.	574	86					
B 73-10	USDA, Maine	511	97					
B 637-14	USDA, Maine	489	98					
B 355-44	USDA, Maine	450	93					
B 61-3	Md. Agr.Expt.Sta.	379	82					
B 75-4	USDA, Maine	367	89					
B 312	N.J. Agr. Expt. Sta.	388	94					
B 211	N.J. " "	400	80					

1/, 2/, and 3/ - See footnotes on preceding page.

New Jersey table 2. Specific gravity data from test plots grown on the farms of Spencer Perrine and Marvin Hulick, Cranbury and Oscar Ketchum, Freehold, in 1950.

Variety, Seed Source	Specific gravity at		
	Spencer Perrine, Cranbury	Marvin Hulick, Cranbury	Oscar Ketchum Freehold
Ashworth, N. Y.	1.0670	------	1.0620
Chippewa, Me.	1.0640	------	------
Chippewa, Minn.	1.0645	-------	------
Chippewa #1, Wis.	1.0640	-------	------
Chippewa #9, Wis.	1.0635	------	------
Chippewa #20, Wis.	1.0635	------	------
Chippewa #46, Wis	1.0625	1.0615	1.0610
Cobbler, Me.	1.0660	1.0660	1.0715
Cobbler, N. J.	1.0695	------	------
Cobbler #29, Wis.	1.0655	------	------
Cobbler #60, Wis.	1.0680	------	------
Essex, N. Y.	1.0640	1.0630	1.0605
Green Mountain, Me.	1.0715	1.0780	1.0745
Katahdin, Me.	1.0660	1.0690	1.0660
Katahdin, N. J.	1.0635	------	------
Katahdin, #49, Wis.	1.0655	1.0630	1.0665
Katahdin #50, Wis.	1.0640	------	------
Kennebec, Me.	1.0675	1.0675	1.0655
Mohawk, Me.	1.0695	1.0720	1.0705
Mohawk, N. Y.	1.0690	------	------
Ontario, N. J.	1.0610	------	------
Ontario, Wis.	1.0680	1.0660	1.0615
Pawnee, N. J.	1.0685	1.0635	1.0635
(B76-43) Pungo, Me.	1.0735	------	------
Russet Burbank, Wis.	1.0670	------	------
Russet Rural, Wis.	1.0670	1.0715	1.0680
Russet Sebago, Wis.	1.0650	1.0600	1.0635
Sebago, Me.	1.0660	1.0645	1.0685
Sebago, Wis	1.0665	------	------
Satapa, N. Y.	1.0630	1.0610	1.0640
Teton, Pa.	1.0635	1.0675	1.0635
Waseca, N. J.	1.0630	1.0605	1.0605
B74-4, Me.	1.0680	------	------
B61-2, Md.	1.070	------	------
B31-14, Me.	1.0690	------	------
B73-10, Me.	1.074	------	------
B55-44, Me	1.0695	------	------
B312, Me	1.0690	------	------
BN5, Pa.	1.0620	------	------
U.S.D.A. Seedling, Minn.	1.0675	1.0695	1.0635
Madison, N. Y.	-----	------	1.0645

NEW YORK

F. M. Blodgett, D. A. Roberts and J. J. Natti

Potato Scab Tests in 1950

Only a few seedlings were held over from the previous year's tests for re-testing. These were planted in two places; at the Robson Seed Farms at Hall and the L. T. Dunn & Son farm at West Henrietta. They were planted in 4 replications of 20 hills each at each place with a few standard varieties for comparison.

In addition, 2 pounds each of some 20 new seedlings were received from Dr. F. J. Stevenson of the U. S. Department of Agriculture for testing. These with a few standard varieties were planted in the same two places but in two replications of five hills each in each place.

The information given by Dr. Stevenson about these seedlings was as follows:

Variety or Pedigree	Parentage	Characters
Yampa	Colorado Seedlings	Scab resistance
B 61-3	96-56 x (X 528-170)	Blight and scab resistance
B 76-23	96-44 x (X 528-170)	Blight and scab resistance
B 76-43	96-44 x (X528-170)	Blight resistance
X 245-186	(X444-12) x Jubel	Scab resistance
B 313-16	Sequoia x 96-56	Hopperburn resistance.
B 400-1	499-a x B 56-11	Scab resistance, red color
B 402-1	499-a x (X528-349)	Scab resistance
B 920-8	B 401-3 x B 355-24	Blight resistance, scab resistance
B 920-12	B 401-3 x B 355-24	Scab resistance
B 962-2	B 81-40 x (X 245-186)	Scab resistance
B 962-9	B 81-40 x (X 245-186)	Scab resistance
B 991-13	B 355-24 x B 81-40	Scab and ring rot resistance
B 2067-23	Chippewa x B 381-2	Scab resistance
B 2067-25	Chippewa x B 381-2	Scab resistance
B 2067-133	Chippewa x B 381-2	Scab resistance
B 2069-74	Chippewa x (X 528-170)	Scab resistance
B 2070-42	Chippewa x B 594-46	Scab resistance
B 2161-3	B 381-2 x B 401-3	Scab resistance
B 2162-11	B 381-2 x (X 528-170)	Scab resistance
B 2162-18	B 381-2 x (X 528-170)	Scab resistance
B 2162-49	B 381-2 x (X 528-170)	Scab resistance

X B76-43 has recently been named Pungo by the Va. Truck Station and USDA.

These plots were planted on May 19 at Robson's and on May 26 at the Dunn farm. The seed was in good condition. The seed held over from the year previous had been indexed in the greenhouse during the winter to eliminate virus diseases. This indexing was successful with most of the seedlings but for B 395-5 the disease symptoms did not show up well in the greenhouse, so that much leafroll

remained to be rogued in the plots. The seed had been warmed up before planting time so that it was well sprouted and ready to grow when planted.

Results of tests at Robson Seed Farms, Hall.

Good yields were obtained on these plots in 1950. Rurals gave a total yield of 533 bushels per acre, but this was exceeded by Ia. 110-16, Kennebec, Katahdin, and Ontario. Of these, only Ontario and Ia. 110-16 were comparatively free from scab culls (table 1) so that these two are far ahead in net salable potatoes. W 305-5 was the only other variety with few scab culls, but this had a poor stand due to the roging for leafroll and also it had a low percentage of tubers of #1 size.

Table 1. Summary - Robson 20-hill plot - 1950.
(Arranged in order of marketable tubers produced).

Variety	Total stand	Total yield per A	#1 size	Scab Culls	Knobs and Cracks	Salable potatoes per A	Total scab	Rhizoc	Maturity 0 = Dead 10 = Green
		Bu.	Pct.	Pct.	Pct.	Bu.	Pct.	Pct.	
Ontario	80	575	91.1	1.0	4.5	353	18.0	1.8	8.8
Ia. 110-16	77	500	95.3	.0	0.8	470	36.8	8.0	8.5
Rural	80	533	95.0	17.8	3.3	395	54.0	44.8	5.0
W 305-5	40	420	83.1	1.0	9.0	311	28.0	0.3	8.8
Kennebec	74	640	97.7	55.5	1.8	263	88.3	35.3	1.0
Katahdin	80	600	97.1	71.0	.3	187	80.5	42.0	2.0
W 136-137	73	417	94.9	50.8	10.0	178	91.5	29.8	8.3
Cobbler	79	491	98.0	60.3	0.3	171	85.3	53.0	0.0
Least Significant Difference		92	6.5	20.4	5.4		17.3	21.1	

Similar data for the five-hill units of new seedlings (table 2) also show good yields for many of these. No very close comparison can be made among these because they are based on only two five-hill plots each. Ten of these seedlings showed net yields of salable potatoes after removal of undersized tubers, scab culls, and misshapen tubers of over 300 bushels per acre and four were passed the 400-bushel mark.

Nearly all of them had tubers of good size. All of them had fewer scab culls than Katahdin and Cobbler but 7 or 8 could not be classed as highly scab resistant. A number of the seedlings show rather serious losses due to ill shaped tubers listed under cracks and knobs. Eight of the seedlings were rated here as earlier than Katahdin and all as earlier than Ontario.

Rotten spots were noted in the tubers of some of these seedlings when they were opened a few weeks after digging. These tubers had been placed directly into cold storage after digging without opportunity for wound healing, which may account for this tendency in part.

Table 2. Summary - Test of two five-hill units - 1950 -- Peterson's Farm.

Seedling No.	Hills	Total yield per A	No.1 size	Scab cull	Knobs and cracks	Net Salable per A	Total scabby	Maturity	
	No.	Bu.	Pct.	Pct.	Pct.	Bu.	Pct.		
Ontario	10	1113	94.6	1.5	3.0	944	25.0	3.0	
B2069-74	10	972	97.1	1.0	1.5	888	33.0	2.0	
B61-3	10	963	97.1	5.0	22.0	693	68.5	.0	Late
B962-3	10	663	94.3	7.0	1.0	573	32.0	1.0	Black rotten
B2067-133	9	835	97.4	18.0	1.5	567	84.5	8.0	Smooth
B2067-23	10	961	97.9	3.0	38.5	556	71.5	5.5	Smooth, long
B2161-3	10	638	93.8	.0	10.5	534	37.5	2.0	Stolon end
B2070-42	10	658	90.1	4.0	6.5	532	46.0	6.5	
X245-186	10	635	95.0	.0	23.5	515	46.0	5.5	Long, tall
X2162-12	10	545	96.7	1.5	3.0	503	37.0	6.0	Late
B76-43	10	842	98.8	34.0	12.5	486	85.5	.5	Late
B2162-11	9	695	89.9	2.0	23.0	471	48.5	4.0	Dirty rot, late
B962-3	8	479	97.5	.5	2.0	462	51.0	1.5	Late
B2067-25	10	750	97.8	43.0	3.5	464	84.0	2.5	
B76-23	9	680	97.9	36.5	8.5	387	92.0	0.5	
B490-1	8	624	95.6	24.5	15.5	381	72.5	2.0	Stolon end
B2162-49	10	404	97.1	.0	6.5	367	3.5	5.5	
B402-1	10	433	96.6	1.5	4.0	355	45.0	.0	Late
B991-13	7	419	94.1	2.0	17.5	318	64.0	.0	
Tampa	6	445	92.2	.0	23.5	314	59.5	6.0	
B920-12	10	382	91.2	12.0	7.5	312	64.5	.0	Some rots
Katahdin	10	371	96.3	74.0	.0	219	96.0	1.5	
B313-16	10	335	96.9	62.5	3.0	180	98.5	4.0	
B920-8	8	624	96.4	67.0	7.5	184	100.0	7.5	
Cobbler	10	212	97.7	90.0	17.0	66	93.5	.0	
L.S.D.		188	4.23	21.4	11.7		33.0		

Results at the Dunn Farm

Good stands and yields were obtained here but the yields were not so extremely high as at Robson's. In the 20-hill plots here Ontario was outstanding both in total yield and in yield of net salable potatoes with few to be sorted out (table 3). Ontario is followed by Kennebec which lost 12 percent from scab culls. Rural was second in total yield, but lost 23.5 percent from misshaped tubers --mostly growth cracks-- putting it in third place in net yields. Katahdin in fourth place lost 23.5 percent from scab culls. The seedlings had comparatively low total yields here in 1950. Seedling B395-5 had the highest total yield of the seedlings but lost over 11 percent from undersized tubers. Seedling B 434-127 lost almost 10 percent from scab culls and Ia. 116-16 was very low in total yield but lost few from sort-outs.

Readings were made in Z disease by clipping the stem ends of all tubers in this test. Rural was high as in previous years and seedling B 434-127 was low as it had also been last year. The others were intermediate but most of them had higher readings than in previous years. This was particularly noticeable with Ontario.

Table 3. Dunn's 20-hill units, 1950

Variety or seedling	Total yield per acre	#1 size	Scab culls	Knobs & cracks	Net salable per acre	Scab	Rhizoc.	Z disease	Maturity 0 - Mature 10 - Green
	Bu.	Pct.	Pct.	Pct.	Bu.	Pct.	Pct.	Pct.	
Ontario	567	95.5	0.00	5.50	511	26.5	1.0	34.8	8.0
Kennebec	521	94.0	12.00	4.50	411	77.0	3.3	46.5	0.2
Rural	538	97.4	2.25	23.50	392	42.0	4.5	57.8	5.0
Katahdin	504	95.2	23.50	.50	365	83.8	2.3	28.5	1.5
B 395-5	441	88.6	.00	6.75	364	38.8	2.0	29.5	7.5
B 434-127	416	97.7	9.75	6.25	344	70.0	4.8	6.5	8.2
Ia.116-16	286	94.5	.75	5.00	255	52.5	3.8	44.8	7.5
Cobbler	375	90.7	41.50	5.50	188	96.8	6.5	41.8	.0
L.S.D.	65.7	2.9	6.8	5.4		12.2		14.4	1.7

The Five-Hill Test at the Dunn Farm

Here again (table 4) the seedlings have been arranged in the order of the net yields of salable potatoes after removal of small sizes, scab culls, and those with cracks and knobs. Only six of them have less than 90 percent of #1 size. Only one (B 313-16) showed excessive scab culls, and this was one not selected as scab resistant. About half of them had over 10 percent of tubers of such irregular shapes that they were classed as undesirable. There are five seedlings with net yields over 500 bushels per acre and a dozen over 400 bushels.

Readings were taken on the tubers affected with Z disease by clipping the stem ends and the counts tend to run higher than usual. Only three seedlings showed counts of 10 percent or less, and eight seedlings showed higher counts than Rural, which had 41 percent. Seedling B 61-3 was one of those with a high count as it has shown in previous tests.

Readings were made on the specific gravity of samples of tubers from this test in order to detect those of high specific gravity and thus high starch content. The highest reading was obtained for the Rural. Only six seedlings gave readings of 1.080 or higher and these have a tendency to be among those with low yields whereas those of high yields seem all to be low in specific gravity.

Readings on the maturity of these seedlings at Dunn's indicated that only five of them were as late as Ontario. An encouragingly large number were earlies or mid-season.

Table 4. Results from five-hill units, Dunn Farm, 1950

Variety or seedling	Total yield per acre	#1 size	Scab culls	Knobs & cracks	Net salable per A	Total scabby	Z disease	Specific gravity	Maturity 0 - Dead 10 - Green
	Bu.	Pct.	Pct.	Pct.	Bu.	Pct.	Pct.		
B2067-133	727	97.6	0.0	2.5	692	54.0	10.0	1.069	8.0
Ontario	730	95.1	1.0	2.0	674	23.0	34.5	1.078	7.5
B2069-74	715	94.0	.0	4.0	645	50.0	79.0	1.067	3.5
B76-43	709	95.7	2.5	6.0	622	47.5	35.5	1.071	.0
B2162-11	691	92.0	.0	8.5	582	31.5	25.0	1.079	7.0
B2067-23	783	96.4	.0	26.0	559	74.0	19.5	1.071	9.0
B2067-25	638	94.8	1.5	16.5	497	43.5	7.0	1.073	2.0
Rural	641	95.1	.0	18.5	497	9.5	41.0	1.091	4.0
B400-1	582	89.7	.0	8.0	480	56.0	54.5	1.070	.5
Yampa	555	95.1	.0	11.5	467	55.5	29.0	1.078	4.0
X145-186	498	94.6	.0	4.0	452	50.0	37.0	1.086	.5
B 61-3	599	90.5	.0	18.0	445	50.0	68.5	1.080	.0
B 962-9	515	87.2	.0	3.5	433	19.0	8.0	1.075	.0
B 962-3	615	95.1	3.0	24.0	431	58.0	34.5	1.074	.0
B 76-23	488	97.5	7.5	10.0	396	73.5	64.5	1.078	.0
B2161-3	485	92.3	.0	22.0	349	53.5	41.5	1.088	1.0
B920-8	473	92.1	3.5	22.0	328	71.0	54.5	1.073	7.0
B313-16	461	90.8	16.5	6.5	327	89.5	47.0	1.072	.0
B2070-42	432	85.0	.0	16.0	308	37.5	25.5	1.083	9.0
B402-1	386	84.6	.0	8.0	300	64.0	42.0	1.067	.0
B2162-18	361	92.6	.0	10.5	299	75.0	50.0	1.085	3.5
B991-13	333	90.9	.0	12.0	266	39.5	14.5	1.073	1.0
B920-12	305	80.1	3.0	3.0	230	77.5	42.5	1.065	.0
B2162-49	281	79.8	.0	18.5	183	31.0	48.0	1.086	.5
L.S.D. 19:1	205	10.3	7.7	14.9		26.4	25.1	.008	

Summary Table

A further table (table 5) was prepared by averaging the yield result of these seedlings at the two places in order to get together in one place all of the information available about them. From this table we derive some comments about the individual seedlings. Next to Ontario at the top in net yield is B2067-74 which has a low specific gravity and is extremely high in Z disease, possibly making it of doubtful value.

Next in line is B2067-133 with 9 percent scab culls, a low specific gravity, but one of the lowest in the amount of Z disease. This seedling, although having only limited scab resistance, has so many other desirable characters that it is considered promising.

The next, B61-3, which we recognize as a seedling we have had in quite a number of previous tests, is running true to form with good scab resistance, but with 20 percent ill-shaped tubers. It is fairly early, with specific gravity of 1.080, indicating fair quality, but it had 69 percent showing Z disease. This high susceptibility to Z disease and poor-shaped tubers seem to be its main drawbacks. Number B2067-23 had as its worst fault 32 percent misshaped tubers. The next seedling, B76-43, which has been named Pungo by the U.S.D.A. and the Virginia Station, did not have a high degree of scab resistance for which it was not bred. It was fairly early with about average Z disease but with rather low specific gravity. It had less scab than that for Rural, Katahdin, and Cobbler, and so with its reported blight resistance, it might be useful. B2162-11 seemed to have good scab resistance but was rather high in misshaped tubers, of dirty red color, fairly low in Z disease, and about with Ontario in specific gravity. B 962-9 seems to have no striking defects and was one of the lowest in Z disease.

Dropping below 500 bushels per-acre level in net yields we come to X245-186 with good scab resistance but nearly 14 percent of irregular tubers. It was high in specific gravity with a long tuber rather dull on the surface. B2067-25 had a good total yield but lost heavily from scab culls and cracks to knobs. B2161-3, a bright red tuber of high specific gravity, averaged 16 percent misshaped tubers.

These comments covering about half of the higher-yielding seedlings in this lot will indicate the difficulty of choosing ones that will be good enough to be worth introducing into commercial use. Only tentative selections could be made on the basis of the present trials but even these are hard to find that do not have some rather serious objections. The plan is to try them all again on a larger scale. Although numbers B2067-133, B76-43, B962-9, X245-186, B2161-3, and perhaps B2162-18 appear promising all seem to have some undesirable features that indicate further testing is desirable.

Table 5. Summary, both fields, 1950

Variety or seedling	Total yield per acre	#1 size	Scab culls	Knobs & cracks	Net salable per acre	Total scab	Maturity	Specific gravity	Z disease
	Bu.	Pct.	Pct.	Pct.	Bu.	Pct.			Pct.
Ontario	922	94.9	1.3	5.5	809	24.0	8.3	1.078	34
B2069-74	847	95.6	.5	4.8	767	42.0	2.8	1.067	79
B2067-133	781	97.5	9.0	2.0	630	69.3	8.0	1.069	10
B61-3	781	93.8	2.5	20.0	569	59.3	.0	1.080	69
B2067-23	872	97.2	1.5	32.3	558	72.8	7.3	1.071	20
B76-43 1/	776	97.3	18.3	9.3	551	66.5	.3	1.071	36
B2162-11	693	91.0	1.0	15.8	527	39.0	5.5	1.079	25
B962-9	589	91.0	3.5	2.3	506	35.5	.5	1.075	8
X245-186	597	94.8	.0	13.8	479	45.0	3.0	1.086	37
B2067-25	694	96.3	22.3	25.8	451	63.8	2.3	1.073	7
B2161-3	561	93.1	.0	16.3	442	45.5	4.5	1.088	42
B962-3	547	96.3	3.2	13.0	437	59.5	.8	1.074	35
B400-1	603	92.7	12.3	11.8	431	67.3	1.3	1.070	55
B2070-42	545	87.6	2.0	11.3	420	38.8	7.8	1.083	26
B2162-18	453	94.7	.8	6.8	401	66.0	4.8	1.085	50
B76-23	584	97.7	22.0	9.3	392	82.8	.3	1.078	65
Yampa	500	93.7	.0	17.5	391	57.5	5.0	1.078	29
Kat-Rural	756	96.0	37.0	9.3	358	52.8	2.8 Rural	1.091	41
B402-1	410	85.6	.8	6.0	328	54.5	.0	1.067	42
B991-13	376	92.5	1.0	14.8	292	51.8	.5	1.073	15
B2162-49	343	88.5	.0	12.5	275	20.3	3.0	1.086	48
B920-12	344	85.7	7.5	2.3	266	71.0	.0	1.065	43
B313-16	498	93.9	39.5	4.8	258	94.0	2.0	1.072	47
B920-8	549	94.3	35.3	14.8	256	85.5	7.3	1.073	55
L.S.D.	139	5.7	11.4	10.5		21.1		.008	

1/ Reported to have been named Pungo in Virginia.

NEW YORK

E. V. Hardenburg, Richard Sawyer, and M. W. Meadows

Title: Specific gravity and yields of potato varieties and seedlings in New York, 1950.

Project leaders: E. V. Hardenburg and Richard Sawyer. Data compiled by M. W. Meadows.

Importance of the problem: Great progress has been made in recent years in breeding potato varieties that are high yielding, resistant to disease and insects, and of high market quality. There is still much to be desired from the standpoint of table quality, however. The need for a mealy potato that does not have the weaknesses of Green Mountain is quite evident in New York State, and if it is possible, a variety that does not darken after cooking.

Objects: To test varieties and seedlings for the following: Adaptability, yield of marketable potatoes, market quality, table quality, and disease and insect resistance.

Plan of work and locations: A total of 24 seedlings, new and old varieties, were tested in 6 counties of up-State New York and in 2 counties on Long Island. Trials consisted of 4 replications, each replication containing 25 hills spaced 12 inches apart in the row. Yields of U. S. No. 1 tubers are recorded in N. Y. table 1.

Specific gravity was determined by the weight-in-air, weight-in-water method. These data are given in N. Y. table 2. Average yield and specific gravity data for varieties at all locations are given in N. Y. table 3.

Results: Essex and Ontario continued to produce high yields as they have in years previous. The table quality of Essex is low with Ontario being classed in the same category despite its higher specific gravity reading. Mohawk, Green Mountain, and B 355-44 gave average specific gravity readings higher than 1.080. The seedlings B 355-44 and B 447-98 did not produce very attractive tubers due to lack of uniformity. B 637-14 and B 73-10 gave a high yield of high market quality tubers. The specific gravity tests indicate that the table quality should be about the same as Katahdin. Yampa, a scab-resistant variety, did not perform too satisfactorily up-State because of its tendency to produce growth cracks. This trouble was not so objectionable on Long Island. Madison, one of Dr. Reddick's blight-resistants, did not produce too heavily and was subject to growth cracks and sunburn.

New York table 1. Potato variety trials, 1950. Yields in bushels per acre, U. S. #1.

Variety	Location and yield per acre of U. S. #1							
	Madison (muck)	Tompkins	Oneida	Monroe	Franklin	Suffolk	Nassau*	Erie
	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.
Red Warba	617	247	554	432	566			632
Progress	604	213	393		540	420	800	583
Chenango		295	450	431				630
LaSalle	607	276			364	498	645	391
Cobbler	596	283	502	443	568	557	735	501
Yampa	607	399	370	505	538	571	840	622
Kasota	411	215			456	341	568	501
B 355-44	517	436	398	529	443			571
B 637-14	524	312	618	619	589			715
B 447-98	637	293	458	486	599			524
B 73-10	671	385			704			
Houma			598					583
Teton	601	399	609	551	701	623		758
Katahdin	730	351	508	586	573	516	727	643
Madison	439	288	427		556	508	672	699
Ashworth	553	349	504	563	625	586	762	804
Essex	756	470	490	560	727	704	993	846
Canus	696	286	389	482	471	555	812	581
Green Mountain					655	607	840	
Mohawk	519	387	514	562	591	517	685	712
Sebago	583	409	554	549	599	513	867	709
Pontiac	673	426	490	641	719	618	1,035	630
Red Pontiac	573	482	441	655	596			735
Ontario (J.M.H.)	571	414	856	618	699	533	992	925
Ontario (K.C.L.)		433	697	558	707			776
L.S.D. 5%	142	55	135	117	88	101		130

Kennebec not included; seed mixed up.
* Total yield.

New York table 2. Potato variety trials, 1950. Specific gravity.

Varieties	Location and specific gravity					
	Madison (muck)	Tompkins	Oneida	Monroe	Franklin	Suffolk
Red Warba	1.0610	1.0788	1.0637	1.0667	1.0739	
Progress	1.0693	1.0780	1.0696		1.0702	1.0700
Chenango		1.0789	1.0674	1.0717		
LaSalle	1.0656	1.0833			1.0692	1.0732
Cobbler	1.0644	1.0819	1.0693	1.0718	1.0747	1.0714
Yampa	1.0580	1.0881	1.0708	1.0764	1.0768	1.0814
Kasota	1.0606	1.0797			1.0649	1.0699
B 355-44	1.0739	1.0960	1.0717	1.0822	1.0841	
B 637-14	1.0620	1.0742	1.0662	1.0607	1.0619	
B 447-98	1.0645	1.0812	1.0671	1.0677	1.0700	
B 73-10	1.0621	1.0825			1.0740	
Houma			1.0758			
Teton	1.0620	1.0846	1.0660	1.0674	1.0708	1.0765
Katahdin	1.0675	1.0831	1.0646	1.0691	1.0717	1.0721
Madison	1.0644	1.0865	1.0682		1.0772	1.0807
Ashworth	1.0539	1.0715	1.0647	1.0595	1.0660	1.0659
Essex	1.0610	1.0747	1.0630	1.0611	1.0661	1.0687
Canus	1.0613	1.0755	1.0588	1.0636	1.0655	1.0700
Green Mountain					1.0828	1.0911
Mohawk	1.0720	1.0905	1.0713	1.0789	1.0831	1.0873
Sebago	1.0675	1.0816	1.0678	1.0713	1.0745	1.0726
Pontiac	1.0577	1.0710	1.0626	1.0609	1.0651	1.0615
Red Pontiac	1.0618	1.0771	1.0620	1.0586	1.0629	
Ontario (J.M.H.)	1.0674	1.0803	1.0736	1.0769	1.0722	1.0791
Ontario (K.C.L.)		1.0796	1.0715	1.0711	1.0720	

Kennebec not included; seed mixed up.

New York table 3. New York potato variety trials, 1950.
Yield and specific gravity averages

Variety	Average yield per acre U. S. #1		Specific gravity	
	Bu.	Rank	Spec. Grav. 1/	Rank
Red Warba	508	16	1.0688	17
Progress	459	22	1.0714	14
Chenango	452	23	1.0727	11
LaSalle	427	24	1.0728	10
Cobbler	493	19	1.0723	13
Yampa	516	15	1.0753	6
Kasota	385	25	1.0688	17
B 355-44	482	21	1.0816	2
B 637-14	563	11	1.0650	19
B 447-98	500	17	1.0701	16
B 73-10	587	8	1.0729	9
Houma	591	7	1.0758	4
Teton	606	5	1.0712	15
Katahdin	558	13	1.0714	14
Madison	486	20	1.0754	5
Ashworth	569	10	1.0636	21
Essex	650	2	1.0658	18
Canus	494	18	1.0658	18
Green Mountain	631	4	1.0870	1
Mohawk	543	14	1.0805	3
Sebago	559	12	1.0726	12
Pontiac	600	6	1.0631	22
Red Pontiac	580	9	1.0645	20
Ontario (J.M.H.)	659	1	1.0749	7
Ontario (K.C.L.)	634	3	1.0736	8

1/ 1.0800 or above = Mealy
1.0750 to 1.0800 = Fairly mealy
1.0700 to 1.0750 = Not mealy
1.0700 or below = Soggy.

NEW YORK (ITHACA)

U.S. Plant, Soil, and Nutrition Laboratory

William C. Kelly

Vitamin C Content

The ultimate aim of the U. S. Plant, Soil, and Nutrition Laboratory is more nutritious food. Of the many factors that affect the nutritive value of crops, genetic factors offer one of the greatest opportunities in the improvement of the nutritive value of food plants. The high nutritive value attained by breeding is permanent and does not entail any change in cultural practices or in food habits. Reliable sources have estimated that potatoes furnish about one-third of the nation's vitamin C. Potatoes furnish a much greater proportion of the vitamin C consumed by rural and low-income families. Thus, an increase in the vitamin-C content of potatoes would have far-reaching benefits.

The factors affecting the vitamin-C content of potatoes have been studied for several years, and it was found that storage and variety were the most important factors. Since potatoes are consumed throughout the year and are an especially important source of vitamin C during the winter months, it is essential that the varieties be evaluated after a period of storage. Potatoes begin to decrease in ascorbic acid content as soon as the tops die and continue to decrease throughout the storage period. The loss is rapid during the first 2 or 3 months, and thereafter the loss proceeds at a slower rate. The evaluation of the effects of location, season, and varieties can best be made as soon as the tops die with another analysis after about 4 months in storage at a specified temperature. During the course of this study about 25,000 samples of potatoes have been analyzed for vitamin C.

For the last two seasons, this study has been carried out in cooperation with the potato-breeding program of the Bureau of Plant Industry, Soils and Agricultural Engineering. About 85 varieties and parent materials have been analyzed for both years. There is apparently a marked season x variety interaction as indicated in Kelly table 1. The correlation coefficient for the 2 years after 4 months of storage was $r = +0.259$. The progeny of Mohawk x B355-24 was analyzed both years, and while some season x variety interaction was evident the correlation coefficient for the 2 years after storage was $r = +0.716$. The progeny from a single cross is much more uniform genetically than the variety collection and for this reason would probably react to the environment more uniformly. Some of the vitamin-C values for this cross are also presented in the table.

No parent has been studied so far that transmits an exceptionally high vitamin-C content to its progeny, but Chippewa seems to transmit a low vitamin-C content to its progeny. In 1949 only 5 progeny lines were analyzed and 4 of these had Chippewa as one parent. In 1950 19 lines were analyzed and 4 of these had Chippewa as one parent. The distribution of individuals in the various classes of vitamin-C content after storage is presented in the table. The possibility of obtaining a high vitamin-C variety from Chippewa seems rather remote. Mohawk does seem to offer some hope, but an even better parent may be uncovered later.

Kelly table 1. Vitamin C - Mg./100 gm.

Variety	1949 Crop		1950 Crop	
	At harvest	4 Mo. storage	At harvest	4 mo. storage
American Giant	38.3	16.2	34.5	12.3
Mohawk	27.9	13.7	27.6	11.6
Katahdin	27.7	10.8	34.4	10.0
Green Mountain	27.5	10.9	27.3	9.7
Spaulding Rose	26.2	14.4	33.6	13.5
Chippewa	20.7	9.0	21.6	8.6
X245-186	27.3	11.8	46.6	20.3
X528-170	22.7	8.2	43.3	14.9
Parnassia	26.9	8.8	38.2	13.9
Rheingold	24.7	9.1	43.6	14.8
Ostbote	25.0	9.3	46.4	16.9
Starkeragis	24.7	10.9	30.1	13.7
Voran	27.7	11.1	36.3	14.5
Mohawk x B355-24				
B2098-29	33.8	19.0	30.0	15.8
- 5	32.2	15.3	24.7	11.3
-43	29.7	12.9	29.7	15.0
-26	29.5	12.7	28.8	14.5
-12	27.6	12.7	27.7	15.3
- 9	24.4	12.1	24.7	11.1
-16	26.5	10.7	25.3	14.5
-17	23.5	10.2	24.6	14.5
- 8	18.9	6.3	28.3	9.9
-50	17.9	7.3	21.4	7.0

Percent of progeny with designated vitamin-C contents after 4 months of storage

	Crop year	Above 11.0 Pct.	Above 12.0 Pct.	Above 13.0 Pct.
Mohawk cross	1949	20.9	13.2	3.8
Chippewa crosses	1949	.5	.3	.0
Mohawk cross	1950	41.5	24.5	20.9
Chippewa crosses	1950	5.8	2.2	.8
All other crosses	1950	19.5	8.0	3.5

NEW YORK (Cornell Univ.)

J. R. Livermore

Responding to Dr. F. J. Stevenson's request this is a brief outline of the potato-breeding project within the Department of Plant Breeding at Cornell University.

Title: The production of potatoes of improved quality that are higher yielding, with insect and disease resistance, for New York conditions.
Leaders: J. R. Livermore and graduate assistant
Importance: Up-State New York potatoes frequently sell at a discount because of poor quality. High yields per unit of land and labor are essential to profitable potato production. Incidence of leaf roll is the bottleneck in the production of new strains by the plant breeders.
Object: To develop new strains and varieties of potatoes that produce high yields of tubers that are attractive, of good eating quality, and are disease and insect resistant, so that more potatoes will be consumed and that the crop may be produced more economically.
Plan of work: Intercrossing and intracrossing among present-day varieties, other species of Solanum, and new seedlings; to select for leaf roll resistance and to incorporate leaf roll resistance germ plasm in the breeding program; to hybridize tetraploid forms of certain wild species with high-quality S. tuberosum varieties and seedlings; to maintain superior clonal lines by frequent tuber-indexing and tuber-unit planting.
Location: At Ithaca and various potato areas of the State.
Results: The Plant Breeding seedling #2V2452, which was found to be quite field-resistant to leaf roll under Ithaca conditions, has been named Canoga.

The European variety Albion was pollinated by Katahdin in 1938, and a seedling from this mating was pollinated by Katahdin in 1940. Both crosses were made in the breeding garden at Gabriels, N. Y. The 2V2452 or Canoga was one of the seedlings from the second cross. The Canoga bakes white and mealy; the tuber is thick-round and does not crack,,nor produce second growth even under the worst conditions; the skin is creamy white and slightly flaky; it is somewhat resistant to leafhopper and the tarnished plant bug; it is a good chipping potato; and it is high yielding.

Among the named varieties now available to the growers the Kennebec and Essex are considered to be the best in yield in this State. In Livermore table 1

Livermore table 1. Yields calculated in bushels per acre of U.S. #1 potatoes

Variety	Location and yield U.S. # 1 per acre					Average
	Allegany	Chenango	Genesee	Washington	Wayne	
	Bu. 1/	Bu.	Bu.	Bu.	Bu.	Bu. 2/
Kennebec	325	794	337	343	531	466
Canoga	309	738	242	245	592	425
Essex	297	672	239	197	521	385

Continued Livermore table 1.

Variety	Location and yield U.S. No. 1 per acre					Average
	Allegany	Chenango	Genesee	Washington	Wayne	
	Specific gravity of the same lots					
Kennebec	1.076	1.074	1.067	1.069	1.064	
Canoga	1.081	1.074	1.069	1.071	1.066	
Essex	1.069	1.063	1.059	1.066	1.058	
Highest of 8 varieties	1.082	1.074	1.068	1.071	1.067	

1/ These figures are averages of 16 plots of each variety, in each county..
2/ A difference of at least 56 bushels an acre is necessary between any two of these five-county variety averages that the probability against its occurrence being due to chance shall be .95.

the figures repressnt the calculated acre yield of Canoga as compared with Kennebec and Essex. These data were provided by Dr. A. J. Pratt who conducted a very well-designed experiment in several counties of New York in which there were eight varieties, with irrigation and without irrigation, early and late planting, mulch and no mulch, and with these variables in all possible combinations. In addition the specific gravity for each lot was determined by Dr. Pratt, and those figures are in the second part of table 1. The 1950 data from a similar experiment are not yet available. The data presented in table 1 are from the 1949 tests.

Considerable progress has been made in developing seedlings resistant to insects. There are varying degrees of resistance among the different lines. It would appear that maturity and resistance to insects are farily closely linked. In any event, early sorts are more likely to be susceptible, whereas the later ones exhibit considerable resistance. We have a few mid-season strains that are quite resistant and produce a fairly good tuber. The problem is to keep out leaf roll long enough that these seedlings may be tested adequately for yield and other characters.

It begins to appear that we are making some progress toward leaf roll immunity. One of the many problems remaining, however, is the apparent close linkage between leaf roll resistance and late maturity. At least in our stocks, the plants with flat leaflets invariably are very late maturing. One strain, on which viruliferous aphids were caged and from which no leaf roll could be recovered afterward, is quite late. Naturally we are continuing this strain in our hybridization plantings in the greenhouse in spite of its lateness.

This year we tried digging single hills by machine and found it to be a very efficient method. A job that used to require six men working 4 to 5 days, was completed in less than 2 days, using a crew of four men. The crop was in better shape, too, for no matter how carefully they are dug by hand, some tubers always are spoiled by fork injury. Using a level-bed digger, with hills 3 feet apart, there is almost no chance of mixture.

NEW YORK

D. Reddick and L. C. Peterson

The Season

The summer of 1950 was cool and at the outset favorable for blight. A few outbreaks of blight were checked by dry weather. September was exceptionally wet in most parts of the State. Blight became prevalent but not abundant.

Current-season infections of rugose mosaic were common. Again, there were indications that the virus had been brought to the flower by insects --lesions occurred on peduncles and leafdrop on the shoots that bore the flowers.

Blight

Late blight has been observed on all of the newly released blight-resistant varieties in New York State. The organism has been isolated from these infections, and inoculation tests indicate that a new race and only one race is responsible for all of these infections. Two other distinct races of the late blight organism have been isolated from infected plants in our breeding plots. In all cases, these resistant plants became infected late in the growing season after a season exceptionally favorable for the development of any epiphytotic of the disease. Within the past few years, blight has been found early in the growing season on a few of the blight-resistant varieties, indicating a successful perennation of the new race and its probable establishment in certain areas.

Three distinct blight-resistant factors have been identified in material derived from Solanum demissum. This work has been done in close cooperation with Dr. W. R. Mills of Pennsylvania State College. Intercrossing plants with the three known resistance factors has been carried on for the last 2 years. All new seedlings are inoculated with a combination of the three races found in the field with the object of producing plants resistant to all three of the races. Preliminary sampling would seem to indicate that this object has been achieved. About 6,000 blight-resistant seedlings were grown in the autumn crop in the greenhouse this year.

A few of the selections made in 1949 have a very fine appearance and have produced an excellent crop. Selections have been made from about 2,000 seedlings.

Scab

Many of the new crosses mentioned under "Blight" have one or two scab-resistant parents. The "conditioning" of the scab nursery in 1949 was not effective. Very little scab appeared on the susceptible varieties even though this same area gave most satisfactory results in 1948. Some work on the biology of Actinomyces scabies has been instituted.

Three attempts, two in the greenhouse and one in the field, have been made to determine the scab reaction of the Correll collection of species from Mexico. No infection has been obtained except on the controls. Stolons insulate the

tubers from the soil when plants are grown in pots; in the field very few plants produce any tubers at all before freezing weather sets in.

Viruses

Current-season spread of rugose mosaic was abundant in mid-season. Seedlings were exposed in alternate rows with plants carrying virus Y. Some plants in the plot contracted the disease and died; others showed no symptoms whatsoever. The virus content of such hills will be examined to determine whether any contracted the disease without symptoms and whether by chance some plants are not affected at all.

A large number of seedlings were inoculated in the greenhouse by rubbing with virus Y. On the basis of symptoms, plants were placed into three groups -- systemic, no reaction, and necrotic reaction with local lesions. Tubers from plants in the last two groups were saved to see whether the virus was present without exhibiting typical symptoms and for reinoculation with the virus.

Intercrossing varieties and seedlings possessing some leaf roll resistance has been carried on for the last few years. Seedlings produced from these crossings, as well as varieties and seedlings possessing some leaf roll resistance, were exposed in alternate rows with plants infected with leaf roll. Viruliferous aphids were introduced into the plot, and the aphid population remained high during the greater part of the season. Tubers were saved for testing for the presence of leaf roll in the greenhouse. An exceedingly small number of varieties or seedlings have survived this treatment without a material increase in leaf roll, while most become 100 percent infected with leaf roll within a very short time.

Black Spot

Black spot, apparently induced by bruising, consists of a blackening of the tissues under the skin of the tuber which may be scarcely discernible until the tuber is peeled. A large number of varieties and seedlings have been tested for their susceptibility to black spot, and a marked variation exists in their reactions. A few varieties exhibiting a marked variation in susceptibility to black spot have been inbred in order to determine whether a correlation exists between susceptibility and mealiness as measured by specific gravity.

It has been determined that black spot is not caused by or associated with any of the common potato vira. Mechanical inoculations to a wide variety of tester plants have failed to demonstrate the presence of any now known virus.

NORTH CAROLINA

Fred D. Cochran

The 1950 breeding program in North Carolina has been conducted along lines similar to those of previous years. Particular emphasis is placed on the development of adaptable varieties possessing market appeal, carrying quality, medium maturity, and resistance to such diseases as southern bacterial wilt, late blight, and scab. In the past, emphasis was entirely on white varieties; however, in 1950 red progenies were added to the program. The search for a source of resistance to southern bacterial wilt and the breeding for resistance is conducted jointly between Plant Pathology and Horticulture. In this program, the family lines are tested at Cash Corner, N. C., on wilt soil and concurrently maintained and increased at Jefferson, N. C. Lines and selections surviving, or showing low incidence of the disease, at Cash Corner were harvested in the mountains and kept for further testing. The nature and description of the disease phase of this work is reported separately.

In eastern North Carolina, performance and evaluation tests on new varieties and selections were continued. Extended rains at Plymouth caused heavy damage to the Irish potato plots and very little information was obtained from evaluation tests of 200 selections. Some indications were obtained on possible differences of clones to withstand adverse conditions. In extreme cases, all tubers of certain selections had rotted while a few stood up well in all replications. These selections will be planted again in 1951.

In 1950, 5,149 seedlings were grown from seed furnished by Dr. F. J. Stevenson. The seed was planted in August 1949, and the seedlings were grown in the greenhouse at Raleigh, N. C. during the fall and early winter. Tubers were harvested in late December and placed in storage at 50° F. until April 1, 1950. The seedlings representing 72 family lines were planted the first week in April at Jefferson and Laurel Springs. At harvesttime 321 selections were made. This was about 6 percent of all the seedlings grown. A number of new varieties were tested for yield and specific gravity in comparison with Irish Cobbler at Camden, N. C. The data for these tests are given in Cochran table 1.

Essex was the only variety that outyielded the Irish Cobbler significantly. Marygold, White Cloud, Chenango, and Ashworth were in the same class as Cobbler with respect to yield but Snowdrift, Cherokee (B61-3), Kennebec, Sebago, and LaSalle were all lower in yield than the check variety. The specific gravities were all relatively low.

Cochran table 1. Variety test at Camden, N. C. - 1950

Variety	Average yield per acre U.S. No 1 1/	Specific gravity
	Bu.	
Essex	694	1.0536
Marygold	543	1.0653
White Cloud (N.C. Seed Source)	542	1.0658
Irish Cobbler	532	1.0640
Chenango	522	1.0636
White Cloude	522	1.0589
Ashworth	504	1.0505
Snowdrift	457	1.0619
Cherokee (B61-3)	423	1.0509
Kennebec	377	1.080
Sebago	360	1.0486
LaSalle	311	1.0585
L.S.D. at 5% level	53	.0081
1% level	71	.0109

1/ Plot 1/125 acre.

NORTH CAROLINA
L. W. Nielsen, Plant Pathology
Fred D. Cochran, Horticulture

Section I. Breeding Irish Potatoes Resistant to Southern Bacterial Wilt.

Pseudomonas solanacearum, the causal pathogen of southern bacterial wilt of Irish potatoes, limits the production of this crop on many acres of land in the early-potato-growing section of eastern North Carolina. Soil treatments to control the disease are economically impractical and offer only temporary control.

Potatoes infected with southern bacterial wilt are a great liability when shipped to market, as it is virtually impossible to sort all infected tubers from the commercial package.

The objective of this section of the project is to locate resistance to Pseudomonas solanacearum and incorporate this resistance into a horticulturally acceptable potato variety or varieties.

In searching for resistance to Pseudomonas solanacearum established breeding varieties or selections, Solanum species, introductions from tropical or sub-tropical countries, and self- or cross-pollinated populations from these stocks are evaluated under field conditions or by artificial inoculations in the greenhouse. The field evaluation is carried out in eastern North Carolina in Pamlico county in soils heavily infested with the pathogen.

Evaluation of Irish Potatoes for Resistance To Southern Bacterial Wilt in 1950

The potatoes were planted March 23, 24, and 25, 1950. Owing to the large number of potatoes planted this year, additional land was taken into the test area. This land had not been cropped to potatoes for 7 or 8 years, and the disease was not as severe here as in that soil cropped to potatoes continuously.

Southern bacterial wilt appeared in scattered hills the week of May 14, and disease readings were first made May 24 and 25. The potatoes were examined at approximately weekly intervals until July 14 when the last disease readings were made. Making the disease readings at weekly intervals made it possible to eliminate a greater proportion of the plants susceptible to the disease than has been accomplished in previous years.

The threat of late blight that developed in early May was kept under control with weekly applications of fungicidal dusts. Six applications were made.

One hundred and seven family lines of potato seedlings were planted. These were represented by 4,903 individual hills. The performance of the family lines is summarized in N. C. table 1. The information given in this table includes the family designation (usually a number), the parentage of the family line, the number of hills that developed wilt, and the number of hills that remained free of the disease.

N.C. table 1. Wilt resistance performance of family lines. One hill of each seedling planted.

Family	Parentage	Hills with wilt	Free of wilt
		No.	No.
3068	Selfed	40	1
Cliuto Blanca	"	5	
Demissum x Katahdin	Demissum x Katahdin	4	
Chihuanhuan	Selfed	5	
Teton	Selfed	20	
Katahdin	Selfed	19	
3355	Selfed	1	
R-1-8-9	Selfed	27	
2861	Selfed	61	3
3567	Selfed	10	
3181	Selfed	1	
586	Selfed	5	
87-1	Selfed	29	
766	Selfed	32	3
Nebr. White	Selfed	18	
X590-20	Selfed	38	
886	Selfed	2	
B 70-4	Selfed	85	1
B 2642	B 759-64 x B 281-81	62	
B 1258	B 281-81 selfed	28	
B 2617	792-133 x B 598-29	74	
X 96-44	Selfed	23	
B 2644	B 778-15 x B 281-81	56	
B 2649	N.C. 2777 x N.C. 2948	67	3
B 2614	157-9 x B 281-81	48	1
B 2606	Reddick blight-immune X B 607-72	55	1
B 2655	N.C. 2948 x B 607-56	66	1
B 1254	Parnassia selfed	49	
B 2648	N. C. 2777 x B 446-58	70	
B 2625	B 355-24 x B 607-56	25	
B 2639	B 607-56 x Russet Burbank Mut.	49	
X 590-7	Selfed	6	
4012	Selfed	63	
B 2651	N. C. 2866 x B 446-58	61	5
B 2609	Teton x B 446-58	22	
B 2597	Earlaine x B 281-81	39	
B 2595	Earlaine x B 607-56	21	
B 1253	Empire selfed	14	
B 2656	N. C. 2948 x 157-9	59	3
B 2650	N. C. 2777 x B 355-24	106	1
B 2636	B 597-2 x B 446-58	22	2
B 2647	N. C. 2777 x B 355-24	103	
B 2603	Parnassia x Katahdin	39	
B 2596	Earlaine x B 607-72	32	
4012 x Kat.	4012 x Katahdin	12	
3862	Selfed	138	

N.C. table 1, continued

Family	Parentage	Hills with wilt	Free of wilt
		No.	No.
B 2653	N. C. 2948 x N. C. 3460	75	3
B 2613	157-9 x Russet Burbank Mut.	36	2
B 2620	B 56-11 x B 607-72	29	1
B 2628	B 446-54 x B 607-56	26	
Katahdin	Selfed	5	
B 2634	B 595-183 x B 607-56	21	1
2828	Selfed	22	
Erie	Selfed	14	
B 2189	41956 x B 522-33	6	
B 2075	Erie x Teton	18	
B 2183	792-94 x B 445-41	4	
B 2119	Sebago x B 445-41	26	
B 2178	792-88 x B 351-44	14	
B 2175	Sebago x B 445-41	35	
B 2124	Teton x B 445-41	43	
B 2154	B 355-24 x B 445-41	39	
B 2156	B 355-44 x B 355-24	23	
B 2176	750-10 x B 522-33	28	
B 1242	B 434-57 selfed	22	
B 2170	528-170 x B 522-33	32	
B 2099	Mohawk x B 445-41	118	
B 2076	Erie x B 61-3	45	
B 2167	B 446-54 x B 401-3	98	
B 2153	B 355-24 x B 355-44	42	
B 2182	792-94 x B 355-44	56	2
B 2157	B 355-44 x B 351-44	3	
B 2172	B 594-46 x B 355-44	16	
B 2074	Empire x B 445-41	24	2
B 2123	Teton x B 355-44	65	1
B 2404	B 275-77 x B 446-58	52	2
B 2117	Sebago x B 355-44	55	8
B 2403	B 275-77 x B 355-24	72	4
B 2383	B 759-64 x B 606-3	34	
B 2409	B 281-81 x B 355-24	155	2
B 2415	B 434-141 x B 434-57	116	12
B 2407	B 275-166 x B 281-81	92	13
B 2417	B 301-89 x B 437-57	109	11
B 2413	B 434-57 x B 607-56	76	1
B 2394	B 607-72 x B 355-24	48	3
B 2385 & B 2387	B 779-1 x B 582-33 & Friso x Flava	57	3
B 2389	Teton x B 446-58	12	1
B 1241	B 281-81 selfed	59	2
B 2416	B 301-89 x B 446-58	64	8
B 2392	B 607-56 x B 402-1	94	9
B 2410	B 281-81 x B 607-56	53	27

N.C. table 1, continued

Family	Parentage	Hills with wilt	Free of wilt
		No.	No.
B 2441	Ackersegen x Flava	61	59
B 2391	B 607-56 x B 355-24	66	19
B 2384	B 778-15 x B 582-33	47	19
B 2399	Kennebec x B 445-41	61	1
B 2411	B 281-81 x B 434-57	51	3
B 2414	B 434-141 x B 355-24	72	11
B 2393	B 607-56 x B 446-58	41	9
B 2405	B 275-77 x B 281-81	39	9
B 1243	B 434-141 selfed	17	7
B 2386	Furore x B 446-58	23	8
B 2442	Calrose x Flava	14	4
B 2446	Katahdin x Flava	17	16
B 2412	B 434-57 x B 355-24	33	9
B 2406	B 275-77 x B 434-57	20	15
B 2390	B 607-37 x B 607-56	29	4
B 2408	B 275-166 x B 434-57	32	1
	Total	4,567	336
	Grand total 4,903		

Only 336 individual hills remained free of the disease. This number is 6.8 percent of the 4,903 planted. All of the plants in many family lines became diseased. There were some family lines with a high proportion of survivors (B 2410 and B 2441). This suggests some resistance in these particular crosses. Unfortunately these family lines, as well as the others comprising the last one-third of table 1, were planted in the land not planted to Irish potatoes in recent years.

All of the survivors from this test will be planted again in 1951 in that land continuously cropped with potatoes.

One hundred and seventeen selections that had escaped or had a low percentage of disease during the past 3 years were planted in a lattice design test to further eliminate the more susceptible selections. Each selection was planted three times in 10-hill plots. The disease readings recorded for this group of seedlings are summarized in N. C. table 2.

N. C. table 2. Summary of bacterial wilt readings from 117 varieties and selections that had remained relatively free of disease in previous years. Each selection replicated 3 times in 10-hill plots.

L.S.D. value	Selections	Selection designation	Parentage	Plants with wilt --adjusted*
	No.			Pct.
Not sig.	99			84.5 to 100
5%	7			74.1 to 84.5
		B 100-3		76.6
		2777	President x Katahdin	84.1
		2928	Green Mt. x 336-144	81.9
		3027	?	78.4
		3192	Earlaine x 46952	78.6
		3870	1241-91 x 247-48	78.6
		4023	Chippewa selfed	81.1
1%	11			Less than 74.1
		638	Prisca	40.5
		2069	?	48.5
		2801	President x Katahdin	70.7
		2823	" "	65.2
		2866	" "	69.9
		2909	Green Mt. x 336-144	60.2
		3355	96-44 x 336-144	73.3
		3746	Houma x Shamrock	66.6
		3820	Houma x Katahdin	48.5
		3873	1276-179 x Shamrock	65.3
		141.1-1	?	60.8

* Computed from angular transformations.

Wilt developed in some or all the plants of each selection. On the basis of the statistical analyses, 18 selections exhibited some resistance. These selections will be further tested in larger plantings to more critically measure their disease resistance.

A group of 12 varieties and selections were included in a third more comprehensive test. These are potatoes reported to have some resistance in various parts of the United States or the world, and certain selections that have shown greatest promise in the North Carolina tests. These varieties and selections were replicated 7 times in 10-hill plots. The disease readings are summarized in N. C. table 3.

N.C. table 3. Southern bacterial wilt readings of varieties and selections replicated 7 times in 10-hill plots.

Variety or selection	Hills with wilt	
	July 6	July 14
	Pct.	Pct.
Cobbler	100.0	100.0
Golden Wonder	100.0	100.0
Katahdin	100.0	100.0
2878	39.7	81.0
142.10-9	100.0	100.0
2983	59.7	94.3
Teton	96.6	98.4
1286-185	98.4	100.0
Green Mountain	100.0	100.0
2985	43.2	70.7
Mohawk	100.0	100.0
2808	100.0	100.0
2840	100.0	100.0

All varieties and selections became diseased, but several selections remained relatively free of the disease until the last two dates of reading. These selections --2878, 2983, and 2985-- were among those showing promise in 1949. They also may have a low level of resistance, and will be used for additional field tests and breeding purposes.

A total of 11 foreign introductions from Brazil were also tested, and all were susceptible to wilt.

Several Solanum species evaluated for resistance were grown from true seed in the greenhouse. After the plants had emerged from the soil and grown to several inches their roots were inoculated with the wilt bacterium. The plants were counted before inoculation and a record was kept of the survivors. These data are presented in N. C. table 4.

A great majority of the plants were killed by wilt. As the summer progressed the number of survivors dwindled in number. None of the species produced true seed under the conditions of growth, but tubers were harvested from most of the survivors and these will be planted for a second evaluation.

No potato or Solanum species has been found to date that possesses a high level of wilt resistance. Those selections that appear to have some resistance as shown from the present information will receive first consideration in future work. The introduction of other national and foreign material to be included in future work is also being pursued.

Table 4. Solanum species tested for wilt resistance in the greenhouse.

Solanum species	Plants inoculated	Plants free of wilt, Aug. 30, 1950
	No.	No.
Solanum andigenum	156	0
S. caldasii var. glabrescens	22	3
S. chacoense	20	0
S. demissum	503	5
S. polyadenium	33	0
S. species	366	5
Wild potato - Mexico	131	8

NORTH DAKOTA

W. P. Baird and Gene S. Howard

Twenty-six varieties of potatoes were grown in one test at the Northern Great Plains Field Station, Mandan, N. Dak., each variety being replicated five times in randomized blocks. The results of this test are shown in North Dakota table 1. A cool summer season, together with other favorable conditions, resulted in high yields for this dry land potato test. The first killing frost occurred on October 2.

North Dakota table 1. Potato variety test at the Northern Great Plains Field Station, Mandan, N. Dak. Planted May 24 and harvested September 29, 1950.

Variety	Average yield U. S. #1 per acre	#1 Compared with total	Estimated green foliage at time of harvest
	Bu.	Pct.	Pct.
Sequoia	346	94	99
Russet Rural	313	84	90
Pontiac	301	94	40
Erie	291	88	86
Rural New Yorker	284	89	92
Kennebec	275	90	66
Teton	274	88	44
White Rose	273	88	86
Mohawk	273	94	82
Chippewa	265	88	35
Norkota	255	86	84
Earliane 2	253	88	62
Green Mt.	251	78	90
Sebago	244	83	91
Irish Cobbler	242	85	3
Mesaba	242	85	3
Katahdin	233	92	78
Earlaine	225	81	9
Red Warba	212	74	4
Houma	205	79	34
Warba	199	75	3
Progress	194	63	20
Pawnee	190	81	9
Triumph	179	80	3
Kasota	167	74	7
46952	136	79	7

L.S.D.--5%--54 bu.-------1%--72 bu. Spacings: Rows 42; hills 18".

NORTH DAKOTA

Wm. G. Hoyman and Harold Mattson

In order to amplify the potato-breeding program in North Dakota, Dr. Wm. G. Hoyman, plant pathologist of the North Dakota Agricultural Experiment Station and the North Dakota State Seed Department, was appointed agent (pathologist) in November 1949. Previous to this time, many USDA seedlings were obtained from Chapman Farm, Maine, during the harvests of 1947 and 1949. The present cooperative agreement with the Federal potato-breeding program and North Dakota will provide for a more extended testing of thousands of seedlings in the Red River Valley. The main objectives will be to study the disease reactions and to cooperate in the breeding of new varieties resistant to virus, fungus, and bacterial diseases.

An arrangement was established with Dr. C. E. Peterson (USDA) of the Iowa Station to increase certain seedlings and breeding material in the Red River Valley. An isolated location at Northwood, N. Dak., was selected for the 1950 plot and future plantings.

The 1950 scab trial was conducted at Fargo on land known to cause severe scab on the common varieties grown in North Dakota. Thirty-five selections from the U. S. Department of Agriculture, 3 from North Dakota, and 3 varieties were included in the test. The susceptible N.D. 530 and ND 509 were planted as checks.

N. Dak. table 1. Scab readings of selections and varieties tested in 1950.

Selection or variety	Amount of scab 1/	Type of scab 2/	Selection or variety	Amount of scab 1/	Type of scab 2/
B294-29	1	3	B2069-74	1	2.5
B313-21	2	3	B2069-75	2	3
B515-2	1	2	B2073	3	3
B524-53	2	3	B2073-11	1	3
B606-37	2	4	B2098-36	4	3
B637-14	4	3	B2100-7	3	3
B725-8	3	3	B2102-8	2	3
B738-8	4	4	B2102-11	2	4
B922-3	3	3	B2118-6	1	3
B924-2	3	3	B2118-63	2	3
B924-13	1	3	B2130-1	2	3
B1172-14	4	3	B2140-15	2	3
B1172-34	1	3	B2162-18	2	4
B2067-4	4	4	B2162-28	2	3
B2067-10	1	3	B2173-22	1	3
B2067-52	4	3	Kennebec	3	3
B2067-129	1	3	Russet Burbank	1	3
B2068-23	3	3	Snowdrift	5	3
B2069-1	2	3	N.D. 457-1	2	3
B2069-57	2	3	N.D. 509	5	4
			N.D. 530	5	4

1/ Surface area covered

1 = 1 to 20%
2 = 21 to 40%
3 = 41 to 60%
4 = 61 to 80%

2/ Type of pustule

1 = small superficial
2 = larger but still superficial
3 = large, rough pustules
4 = large pustules with holes

B515-2 continued to show a high degree of resistance. In previous tests conducted at various locations in the Red River Valley, this selection has never had more than type 1 lesions. This year two tubers were found with type 2. The resistant Russet Burbank had one tuber with a type 3 lesion.

B515-2 was sent to eight States and Canada to test for scab resistance in soil known to cause severe scab. The list of cooperators and results are shown in N. Dak. table 2.

N. Dak. table 2. Results of cooperative scab test with B515-2.

Cooperator	Location	Observations
C. E. Peterson	Iowa	Trace of type 1
N. Shenderevich	Manitoba	No scab
L.T. Richardson	South Dakota	No scab
O. C. Turnquist 1/	Minnesota	No report
L. A. Schaal	Colorado	Type 1
Robert Akeley	Maine	Trace of type 1
G. H. Rieman	Wisconsin	No report
H. O. Werner	Nebraska	Trace of type 1
F. A. Gowen	Minnesota	Type 3
J. H. Huncie	Michigan	Deep pits reported

1/ Mr. Turnquist reported that B515-2 was destroyed during cultivation.

Most of the cooperators reported severe scab on their check varieties. In Maine, for example, Robert Akeley reported 3-3 on Green Mountain and only a trace of 1 on B515-2. Severe scab occurred on Cobblers grown on Iowa peat soil at Clear Lake and only a trace of type 1 was reported on B515-2. The reports in table 2 indicate this selection had a high degree of resistance at all locations except Michigan and Minnesota.

In order to confirm or disprove a report that Phygon XL would prevent potato scab, scab-free Pontiac seed was treated with this chemical. The Phygon XL was used at the rate of 1 pound per 100 gallons of water. Freshly cut seed was dipped for 30 minutes and planted immediately. Another lot of freshly cut seed was dipped in water for the same length of time. Since the planting was made in an old scab nursery known to cause severe scab, the treated and check rows were not replicated. Each of the two rows was 240

feet long. The results in N. Dak. table 3 indicate Phygon Xl did not prevent scab on the current crop.

N. Dak. table 3. Amount of scab on tubers harvested from Phygon Xl treated seed.

Treatment	Tubers harvested	Scab-free	Scabby	
	No.	No.	No.	Pct.
Phygon XL	495	294	201	40.6
No treatment	460	308	152	33.0

1/ Tubers with type 1 scab were not included in the table.

The selections B524-53, B1172-14, B1172-34, B2067-10, B2067-52, and B2068-23 were obtained from Dr. F. J. Stevenson as being resistant to virus Y. A plot containing these selections and B515-2, B738-8, N.D. 457-1, Kennebec, and Snowdrift were exposed to natural field infection by planting the alternate rows with N. D. 530, a North Dakota selection known to be carrying virus Y. As a supplement to natural field infection, on August 1, viruliferous Myzus persicae were placed on 3 plants of each selection and variety. The aphids were reared on N. D. 530, and not less than 75 were transferred to each plant. The transfer was made by removing infested terminal branches of N. D. 530. Field readings for virus Y symptoms were taken September 7 and are shown in N. Dak. table 4. Because the plants lacked sufficient

N. Dak. table 4. Field reading of virus Y symptoms..

Selection or variety	Plants showing symptoms
	No.
B524-53	0
B1172-14	0
B1172-34	0
B2067-10	0
B2076-52	0
B2068-23	0
B515-2	3
B738-8	3
N.D. 457-1	1
Snowdrift	0

moisture for normal growth, it was difficult to make accurate readings. Tubers were harvested from all symptomless plants for planting in 1951.

In addition to the three plants of each selection and variety receiving the Y-carrying aphids, there were additional plants of certain selections and the two varieties that were exposed to natural field transmission. The results in N. Dak. table 5 confirm previous observations that B738-8,

N. Dak. table 5. Field transmission of virus Y.

Selection or variety	Plants	Plants showing symptoms
	No.	No.
B515-2 1/	--	--
B738	50	1
ND 457-1	20	0
Kennebec	43	1
Snowdrift	15	0

1/ B515-2 matured too early to make an accurate reading

N. D. 457-1, and Kennebec always show a low percentage of field infection. Snowdrift has never been observed with any virus Y symptoms during the 2 years it has been exposed to infection.

Wm. G. Hoyman

Experiments were started in 1949 to determine if the juice from tubers could be used to index for virus X. The method consisted of rubbing the surface of freshly cut tubers on the carborundum-dusted leaves of Gomphrena globosa. A sterile knife was used for removing the stem ends of tubers to have a rubbing surface of approximately 1 1/2 to 2 inches in diameter. The indexing has been done each month from October through May, and the results have shown the method may be used at any time during the storage months.

Three thousand eight hundred and eighty-two Pontiacs, Triumphs, Cobblers, and Green Mountains, known to be infected with more than one strain of virus X, have been tested the last 2 years, and 28 tubers were negative the first rubbing (N. Dak. table 6). When rubbed the second time all but two tested positive. The two negative Cobblers were grown in the the greenhouse and juice from the petioles tested positive.

N. Dak. table 6. The effectiveness of the tuber juice method when testing Pontiac, Triumph, Cobbler, and Green Mountain known to be infected with virus X.

Variety	Tested	Negative
	No.	No.
Pontiac	1991	6
Triumph	672	6
Cobbler	1006	15
Green Mountain	213	1
	3882	28

While indexing Green Mountain known to be carrying a week strain of virus X, 3 tubers were found that did not produce symptoms on Datura stramonium. These 3 were increased in 1950, and the increase of 112 tubers was tested on Gomphrena globosa by the tuber juice method. The results are given in N. Dak. table 7.

N. Dak. table 7. Results of indexing the increase from three Green Mountain tubers carrying mild virus X.

Tubers	Increased tubers	Testing positive	Testing negative	Average number lesions per leaf of Gomphrena globosa
No.	No.	No.	No.	Ave.
12	34	34	0	22.0
30	43	42	1 1/	17.8
39	35	35	0	18.8

1/ This tuber tested positive when indexed the second time.

From 120 USDA seedlings planted at Grand Forks, N. Dak., in 1948, B515-2 and B738-8 have appeared to be the best adapted to the Red River Valley. B515-2 has been grown at various locations in the State and at several other places in the Midwest. At certain locations its skin looks identical to Russet Burbank and its shape is somewhat similar but generally not so long. This selection has matured in the Red River Valley as early as the early Red Warba. To date it has remained highly resistant to scab wherever grown in North Dakota. Because B515-2 has looked so promising, the small amount of available seed was used for increase instead of distributing it for yield trials. Observations have indicated it will yield approximately the same as Cobbler but probably not comparable to the high-yielding Red Pontiac. Virus-free seed of B515-2 will be increased by North Dakota foundation

growers in 1951. It will also be included in yield trials. Tests conducted in North Dakota have shown that this selection is susceptible to early blight, late blight and viruses X and Y.

B738-8 is the only remaining white-tubered selection from the 1948 test. It looks promising because it has some resistance to late blight, scab and virus Y, and is medium in maturity. The tubers are somewhat round and fairly smooth. Although it has never been increased to the extent that it has been included in extensive yield trials, observations have indicated it is average or better in this respect. B738-8 will be increased in 1951.

Approximately 250 USDA seedlings were selected from Chapman Farm during the harvest of 1949 and planted in an adaptation plot at Northwood N. Dak. In selecting this material attention was given to the appearance and yield of the seedling hills and disease resistance. When the seedlings were harvested in October a surprising amount of vigor was evident in certain seedling families. The B2425 family was outstanding in this respect.

The following 18 seedlings were saved for further tests in 1951.

B2067-129	B2390-ND1	B2425-ND3
B2335-ND1	B2392-ND1	B2425-ND4
B2336-ND1	B2399-ND1	B2425-ND5
B2368-ND1	B2399-ND2	B2428-ND1
B2369-ND1	B2425-ND1	B2429-ND1
B922-3	B2425-ND2	B2440-ND1

NORTH DAKOTA

Harold Mattson and R. Johansen

---

1. Project Bankhead Jones 8-IV: Breeding Potatoes for North Dakota.

2. Project leader: Harold Mattson.

3. Importance of the problem: Potato varieties widely grown in North Dakota lack many desirable vine and tuber characters, including resistance to important diseases, which are available only in certain breeding stocks and new varieties that are not fully suitable for extensive commercial production in this State. The work of this project is to combine these characters in improved varieties adapted to profitable potato production in North Dakota.

4. Objects:

   a. To develop improved potato varieties.
   b. To test the adaptability and value of new potato varieties and selections to North Dakota conditions.
   c. To maintain disease-free breeding stocks and selections.

5. Plan of work and locations: New seedlings were grown from crosses made in the greenhouse and from seed received from cooperators. Selections for desirable types were made in field plantings grown in isolation at the Langdon Experiment Station, and advanced selections were tested in plantings on the research farm of the Red River Valley Potato Growers Association, Grand Forks, North Dak. Variety yield trials were grown at Fargo and Grand Forks and in cooperation with NDAC Experiment Station superintendents at Dickinson, Edgeley, Hettinger, Langdon, Minot, and Williston.

6. Results to date:

Potato Variety Trial

Kennebec, Pontiac, and Red Pontiac produced the highest yields and the largest size tubers in seven trials in five locations in North Dakota in 1950. Progress and Triumph and the white-tuber varieties, Canus, Cobbler, Essex, White Cloud, and Station selection ND 457 were also grown. Trial yields ranged from an average of 251 bushels per acre at Langdon to 348 bushels at Fargo with natural rainfall and 388 bushels per acre under irrigation at Williston. The average yield of the varieties in the seven trials is reported in North Dakota table 1.

North Dakota table 1. Total yield of potato varieties in seven trials 1/ 1950.

Variety	Location and yield per acre							
	Williston Irrigation	Dryland	Fargo	Minot	Grand Forks 6-7	Grand Forks 6-15	Langdon	Average
	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.	Bu.
Kennebec	441	487	411	403	323	298	276	377
Pontiac	405	386	359	402	274	302	333	352
Red Pontiac	436	360	383	366	310	280	296	347
Canus	410	371	347	339	252	217	279	316
Essex	369	404	350	311	279	226	226	309
Triumph	329	334	389	300	283	231	212	297
Progress	430	251	304	307	291	240	191	288
ND 457	371	316	307	253	250	251	261	287
Cobbler	321	288	323	327	265	256	225	286
White Cloud	363	275	304	306	235	219	213	274
LSD 5%	84	60	55	58	52	36	56	34
Average	388	347	348	331	276	252	251	313

LSD 5% between trials: 29 bu.

1/ Four 25-hill rows of each variety in a randomized block trial at each location.

Planting was delayed 2 to 3 weeks because of wet grounds and ranged from May 27 at Fargo to June 7 and 15 for the two trials at Grand Forks. The spacing was 14 x 24 inches in the trials at Williston, 24 x 42 inches at Minot, and 16 x 38 inches in the remaining trials. Growing conditions were generally favorable, and the trials were quite free from virus and other vine diseases.

Cobbler, White Cloud, Triumph, and Progress were medium early; Pontiac, Red Pontiac, Essex, Canus, and ND 457 were medium late. Kennebec was quite late in maturity of foliage. The vines of all but the medium early varieties were quite green in the trials at Grand Forks, Fargo, and Langdon until killed by frost October 2.

The proportion of yield of tubers of four size classes, below 2 1/4 inches, 2 1/4 to 3 inches, 3 to 4 inches, and over 4 inches in diameter, is reported in North Dakota table 2, together with the average tuber weight and the average total yield of the varieties in the seven trials.

North Dakota table 2. Proportion of yield of tubers of four size classes and average tuber weight of potatoes from seven trials 1/

Variety	Average yield per acre	Proportion of yield of tubers				Average tuber weight
		Below 2 1/4"	2 1/4"-3"	3"-4"	over 4"	
	Bu.	Pct.	Pct.	Pct.	Pct.	Oz.
Kennebec	377	7	36	49	8	7.5
Pontiac	352	8	33	53	6	7.1
Red Pontiac	347	7	34	53	6	7.2
Canus	316	13	42	42	3	5.3
Essex	309	17	47	33	3	4.4
Triumph	297	12	49	37	2	5.5
Progress	288	35	55	10	0	3.5
ND 457	287	13	44	41	2	5.4
Cobbler	286	13	47	38	2	5.3
White Cloud	274	26	52	21	1	4.2
LSD 5%	34					0.9
Average	313	15	44	38	3	5.5

1/ Four 25-plant rows of each variety in randomized block trials at Fargo, Grand Forks (two), Langdon, Minot, and with and without irrigation at Williston.

Red Tuber Varieties

Pontiac with 352 bushels per acre and Red Pontiac with 347 bushels per acre were similar in yielding ability and ranked significantly above Triumph which yielded at the rate of 297 bushels per acre and Progress which yielded at the rate of 288 bushels per acre.

Pontiac and Red Pontiac were higher in yield and produced tubers of larger average size than all other trial varieties except Kennebec which yielded slightly more and was slightly above Pontiac and Red Pontiac in average weight of tubers. Pontiac, Red Pontiac, and Kennebec were similar in proportion of tubers of the several size classes. These varieties produced approximately 7 percent of their yield in tubers below 2 1/4 inches in diameter, 35 percent in tubers 2 1/4 to 3 inches in diameter, 51 percent in tubers 3 to 4 inches in diameter, and 7 percent of their yield in tubers over 4 inches in diameter.

Triumph and Progress yielded about the same in four of the seven trials. In the trial at Fargo and in the trial with natural rainfall at Williston, Progress yielded one-fourth less than Triumph, but in the irrigated trial at Williston Progress yielded 100 bushels, and significantly more than Triumph. Progress had slightly less scab than the Pontiac, Red Pontiac, and Triumph varieties, which had moderate scab injury on occasional tubers.

Progress produced small to medium-size tubers and was below all other trial varieties in average weight of tubers. On the average, Progress tubers were three-fifths as heavy as those of Triumph and Cobbler and one-half as heavy as those of Pontiac and Red Pontiac. One-third of the yield of the Progress variety was in tubers under 2 1/4 inches and one-tenth in tubers over 3 inches in diameter.

White Tuber Varieties

Kennebec yielded significantly more than Cobbler in each trial and one-third more than Cobbler in the seven trials combined. Kennebec yielded significantly more than all other trial varieties except Pontiac and Red Pontiac which yielded nearly as well. Kennebec tubers were large in size, averaging slightly above those of Pontiac and Red Pontiac and significantly above those of the remaining trial varieties in average tuber weight. Kennebec had less scab than the other white tuber varieties, ranking with the red tuber varieties in freedom from scab.

Canus, Essex, ND 457, and Cobbler did not differ significantly in yield. The average yield of White Cloud was similar to that of Cobbler, ND457, Progress, and Triumph and significantly below the yield of the other trial varieties. Canus, Cobbler, and ND 457 were similar in Average tuber weight and in the proportion of tubers in the various size classes. Essex and White Cloud were low in average tuber weight and produced respectively one-sixth and one-fourth of their yield in tubers below 2 1/4 inches in diameter. Scab injury was common in White Cloud and moderate in Canus, Cobbler, Essex, and ND 457 in these trials.

Specific Gravity

The specific gravity of the trial varieties was relatively high in 1950, and highly significant differences were found between varieties and between locations. The average specific gravity of the trial varieties is reported in North Dakota table 3, together with the range in the 7 trials and the average specific gravity of 6 of the varieties that were included in 13 similar trials in 1949.

ND 457 and White Cloud were highest in specific gravity, each having an average specific gravity of 1.097, which is significantly above that of the other trial varieties. Cobbler was high, Kennebec medium, Canus fairly low, and Essex lowest in specific gravity, and these white-tuber varieties were significantly different one from the other in this quality.

Progress was high, Triumph intermediate, and Pontiac and Red Pontiac relatively low in average specific gravity. Specific gravity readings were considerably higher than in the trials of 1949, but the varieties that were grown in the two trials maintained the same rank each year.

North Dakota table 3. Specific gravity of trial potatoes.

Variety	Average 13 trials in 1949	Seven trials in 1950 Range	Average
White Varieties:			
ND 457		1.092-104	1.097
White Cloud		1.092-104	1.097
Cobbler	1.089	1.090-102	1.095
Kennebec	1.083	1.084-97	1.090
Canus		1.080-90	1.084
Essex	1.077	1.076-90	1.080
Red Varieties:			
Progress	1.081	1.088-101	1.093
Triumph	1.076	1.083-93	1.088
Red Pontiac	1.072	1.080-89	1.083
Pontiac		1.078-88	1.082
LSD 5%	.004		.002
Average	1.080		1.089

Resistance of Potato Tubers to Puncture Pressure and Skinning

The resistance of tubers of the trial to puncture pressure and skinning was determined in tests made in cooperation with the Department of Agricultural Engineering. The puncture pressure of a small plunger and the torque required for slippage of a tuber held against a carborundum wheel are recorded in North Dakota table 4. Puncture pressure data of 6 varieties from 13 trials in 1949 is also reported in this table.

North Dakota table 4. Resistance of potato tubers from variety trials to puncture pressure and skinning.

Variety		Puncture Index 1/		Skinning Index 4/
White	Red	1949 2/	1950 3/	1950
ND 457			26.2	6.7
Essex		27.0	25.5	6.5
	Pontiac		25.6	7.1
	Red Pontiac	24.1	24.6	7.1
Kennebec		23.3	24.8	6.8
White Cloud			22.8	6.9
	Progress	21.8	22.2	7.0
	Triumph	21.8	22.3	6.9
Cobbler		20.6	21.8	7.0
Canus			21.5	6.6
LSD 5%		1.5	1.1	0.3

1/ Average of four punctures with 0.1545 inch diameter plunger having 0.25 inch radius of curved top on each of four tubers of each variety from the 1949 trials tested in February, 1950, and three punctures of each of ten tubers of each variety from the 1950 trials tested in November, 1950.

2/ Average of trials at Cavalier, Dickinson, Edgeley, Fargo, Crafton, Grand Forks (two), Hettinger, Langdon, Mandan, Minot, Park River, and under irrigation at Williston.

3/ Average of nine trials at Dickinson, Edgeley, Fargo, Grand Forks (two), Langdon, Minot, and with and without irrigation at Williston.

4/ Skinning Index: Torque required for slippage of tuber held with 12 pounds pressure against a three-inch carborundum wheel. Average of two tests on each of ten tubers of each variety. Tested Nov., 1950.

Significant differences between varieties and between locations were found in each test. ND 457 was high, Kennebec intermediate, and Canus lowest in resistance to puncture, but these three varieties were not significantly different in resistance to skinning. Essex, Red Pontiac, and Kennebec were significantly above Cobbler and Triumph in resistance to puncture in 1950 as in 1949. The relationship of puncture pressure data to harvest bruises and skinning and to other characters will be sought in further tests.

Selection B 515-2 was included in the trial with 10 other varieties at Grand Forks and Langdon. It matured with Cobbler and Triumph and yielded at the rate of 232 bushels per acre in comparison with 221 bushels for Triumph and 242 bushels for Cobbler in these trials. B 515-2 was similar to Pontiac, Red Pontiac, and Triumph in specific gravity in these trials, averaging 1.083. Tubers of B 515-2 were free of scab and of good shape with less injury from growth cracks than in 1949.

Potato Crosses and New Potato Seedlings

Potato selections with resistance to scab, late blight, virus Y, or other diseases were used as parents in most of the 225 crosses made in the greenhouse early in 1950. These included B 515-2, B 991-3, Minn. 113.43-1-45, and ND 457.

New potato seedlings were grown in an isolated field at the Langdon Experiment Station. Eighty-seven selections were saved from 4,500 seedlings grown from crosses received from Dr. F. J. Stevenson (Beltsville) and Dr. C. E. Peterson (Iowa). Forty-six selections were saved from 1,900 seedlings received from Dr. H. O. Werner (Nebraska) and 21 from 1,900 seedlings received from Mr. N. Shenderevich of the University of Manitoba. Approximately 700 selections were made from 25,000 seedlings of North Dakota crosses, and a number of selections were made from inbred families. A number of scab-free selections were secured from several families of crosses with scab resistance in one or both of the parents.

Planting of advanced selections at the research farm of the Red River Valley Potato Growers Association at Grand Forks was delayed until the second and third week of June because of wet grounds. Emergence and early growth was slow and there was some injury from 2,4-D from an aerial spraying of adjacent grain fields in mid-July.

Scab was more severe than in recent years. A number of the selections that were quite free of scab had the Cayuga variety as one of their parents. Approximately 200 selections have been saved from the 850 advanced selections planted at Grand Forks.

A few plants (approximately 0.1%) of rugose mosaic were found in Station Selection ND 457. This selection was practically free of necrotic spots of top infection from virus Y as was also the case in 1949.

Rouging resulted in the elimination of approximately 3 percent of the advanced selections at Grand Forks because of unthrifty vines and virus symptoms. Crinkle and rugose mosaic and top infection by virus Y were less common in 1949. Seed stocks for planting in an isolated field at the Langdon Station are being secured in a program of indexing in the greenhouse.

Eighty-four potato selections from cooperators in the Canadian Department of Agriculture, the U. S. Department of Agriculture, and Agricultural Experiment Stations in Minnesota, Nebraska, New York, Pennsylvania, and Wyoming were grown for study and selection. A number of these appear promising and are being used in the crossing program.

OHIO

J. P. Sleesman and John Bushnell

1. Project title: Evaluating insect resistance in varieties and strains of potato.

2. Project leaders: J. P. Sleesman and John Bushnell.

3. Importance of the problem: In the potato sections of Ohio, as well as in other States, the potato insect problem is serious. The annual loss in Ohio, Indiana, Illinois, Wisconsin, and Michigan caused by the potato leafhopper alone is estimated at 12,000,000 bushels. Among the foliage diseases, both early and late blights are important factors in limiting production. Insecticides and fungicides which give good control of these pests are available to growers but the cost of materials, spraying equipment, and labor is quite high.

   The development of varieties resistant to leaf-feeding insects and foliage diseases would result in a considerable saving to potato growers. The development of disease- and insect-resistant varieties must go hand-in-hand, since a variety resistant to one group of pests would require the application of a spray material to protect it from the others.

4. Objectives: The quality-quantity production of potatoes with special reference to the insects which damage the crop.
   1. To study the behavior of potato pests with special reference to strains.
   2. To develop a variety of potato that is insect and disease resisting and one that retains the good qualities of the best known commercial sorts.

5. Plan of work:
   1. Materials to be used:
      1. First-year unselected progenies
      2. Selected seedlings
      3. Wild species
   2. Data to be collected:
      1. Insect population
      2. Insect injury
      3. Yield
      4. Tuber quality

6. Location: Wooster, Ohio

7. Results: Approximately 4,400 first-year seedlings received from Drs. Stevenson and Peterson were grown at Wooster. Data concerning the several progenies are presented in Ohio table 1. About 10% of the seedlings were saved for planting in 1951.

Ohio table 1. Reaction of selfed lines and crosses to leafhopper injury (hopperburn) at Wooster, Ohio. 1950.

Pedigree No.	Parentages	Seedlings tested	Seedlings placed in several classes of hopperburn 1/				
			1	2	3	4	5
		No.	Pct.	Pct.	Pct.	Pct.	Pct.
B 2834	294-38 x 157-9	86	18	28	24	21	9
B 2904	B 301-29 x B 61-3	55	29	31	27	4	9
B 2905	B 301-29 x B 355-35	46	50	20	17	9	4
B 2915	B 595-183 x 528-170	116	53	22	20	4	1
B 2922	B 607-72 x B 598-29	182	--	12	30	25	33
B 2929	Empire x B 1153-10	104	26	27	35	10	2
B 2931	Empire x B 672-70	52	42	25	25	8	--
B 2932	Kennebec x B 672-70	20	10	25	30	25	10
B 3016	B 478-1 x B 582-33	56	38	32	18	9	3
B 3017	Sequoia x 247-24	46	52	20	22	6	--
B 3018	Sequoia x B 962-32	148	32	31	29	6	2
B 3019	Sequoia x B 986-7	55	40	42	16	2	--
B 3020	B 721-29 x B 724-1	34	59	26	15	--	--
B 3021	B 721-30 x B 724-1	134	62	28	9	1	--
B 3022	B 724-1 x Ruska	55	47	44	9	--	--
B 3023	B 724-20 x B 778-43	91	62	22	16	--	--
B 3024	B 724-20 x B 872-70	43	58	28	12	2	--
B 3025	B 364-2 x B 724-1	54	30	48	20	2	--
B 3026	B 963-9 x B 724-1	91	67	22	8	1	2
B 3027	B 929-6 x B 724-1	76	50	32	17	1	--
B 3028	B 577-44 x B 724-1	40	75	25	--	--	--
B 3029	B 724-15 x B 872-70	142	55	35	9	1	--
B 3030	B 478-1 x B 929-6	99	50	39	10	1	--
B 3031	B 724-1 x B 778-43	70	74	26	--	--	--
B 3037	Empire x B 355-35	20	45	50	5	--	--
B 3038	Empire x B 355-44	72	56	36	7	1	--
B 3039	Empire x B 434-91	83	51	30	16	3	--
I 801	B 595-76 x 67-11	56	9	27	36	14	14
I 868	B 96-56 x B 61-3	87	--	22	11	24	43
I 914	B 76-23 x B 96-56	30	3	23	27	20	27
I 915	B 76-23 x M 113.43	80	7	25	18	16	34
I 924	B 96-56 x M 34.44	100	3	35	34	17	10
I 925	B 96-56 x M 113.43	27	11	4	37	22	26
I 938	B 759-61 x B 96-56	40	10	18	25	42	5
I 943	41956 x B 61-3	81	27	31	23	17	2
I 944	Teton x B 61-3	83	17	18	42	19	4
I 946	B 674-24 x 44-13-8	53	19	24	28	19	10
I 948	B 674-25 x 44-13-8	105	24	41	28	6	1
I 949	B 674-25 x M 113.43	94	5	17	39	30	9
I 954	6341 x B 96-56	94	5	27	39	16	13

Ohio table 1 - continued.

Pedigree No.	Parentages	Seedlings tested	Seedlings placed in several classes of hopperburn 1/				
			1	2	3	4	5
		No.	Pct.	Pct.	Pct.	Pct.	Pct.
I 955	7137 x B 96-56	100	--	25	17	43	15
B 1281	B 724-1 selfed	51	53	45	2	--	--
B 1288	B 879-1 selfed	23	--	26	48	4	22
B 1293	B 929-6 selfed	16	25	7	50	18	--
B 1294	B 962-32 selfed	21	14	19	33	34	--

1/ Classes of hopper burn: 1 = 0 to 10%; 2, 10% to 25%: 3, 25% to 50%; 4, 50% to 75%, 5, 75% to 100%.

Seedlings selected in 1949, numbering about 550, were grown in 20-hill plots in 1950. Approximately 8% of these seedlings were retained for further testing in 1951. Nine seedlings were grown in replicated yield trials, and each seedling was compared in sprayed and unsprayed plots with Katahdin and Irish Cobbler. Data on these tests are given in Ohio table 2. Several of the seedlings were highly resistant to late blight, which became epidemic in September, and some of them yielded better than either Katahdin or Cobbler. Seedling B 313-21 yields well but it does not produce tubers of consistently good shape.

Ohio table 2. Yield data for nine seedlings grown in sprayed and unsprayed plots in comparison with Irish Cobbler and Katahdin at Wooster, Ohio 1950.

Variety or seedling	Yield per acre		Late Blight	Maturity
	Sprayed	Unsprayed		
	Bu.	Bu.		
B 313-21	656	670	Resistant	Early
OB 606-10	571	581	Resistant	Late
B 638-16	538	488	Resistant	Early
OB 959	444	489	Resistant	Late
OB 639-2	488	472	Resistant	Late
OB 604-1	489	329	Susceptible	Late
OB 881-1	474	352	Susceptible	Late
OB 934-1	282	136	Susceptible	Late
OB 724-20	206	89	Susceptible	Late
Irish Cobbler	460	337	Susceptible	Early
Katahdin	500	325	Susceptible	Med. late

PENNSYLVANIA

R. E. Hartman (State Department of Agriculture)
and
R. V. Akeley (U.S.D.A.)

Wart-Immunity Tests

The report of wart-immunity studies on the 26 seedlings and named varieties in submitted in Pa. tables 1 and 2 and in the discussion that follows:

1. Seedling numbers and parentage.

2. Germination, vine growth, maturity, wart susceptibility, and yields.

This year's test of wart immunity of seedlings and named varieties was made in heavily infested soil at Bernice, Sullivan County. The area has an altitude of 2,000 feet with a cool, moist climate.

The season was favorable for wart-immunity tests. The rainfall from June 1 to September 15, 1950, was normal, and soil temperatures averaged normal.

Summary of Wart Reaction: Of the 26 seedlings and named varieties tested, 19 showed infection and 7 were immune or at least not infected. All of the 26 checks (susceptible Russets) were infected; of the 258 Russet Rural check-hills, 183 were infected or 70 + %.

In Pa. table 3 is listed the wart reaction of most of the newer varieties released during the last 15 years.

Pa. table 1. Varieties and seedlings tested and their parentage

Row No.	Variety or seedling	Parentage
1	Virgil	N. Y. Seedling
2	Chenango	"
3	Snowdrift	"
4	Essex	"
5	Ashworth	"
6	Placid	"
7	Kennebec	B127 x 96-56
8	Teton	45146 x Earlaine
9	Calrose	Ackersegen x Katahdin
10	Marygold	45208 x Earlaine
11	Seneca	Hindenburg x Katahdin
12	Ontario	R. Jubel x 44537
13	X927-3	AAP 9 x Earlaine
14	B73-10	Mohawk x 96-56
15	B73-16	Mohawk x 96-56
16	B402-1	499-A x 528-349
17	B294-22	Houma x 96-56
18	B355-44	96-56 x 336-144

Pa. table 1 continued.

Row No.	Variety or seedling	Parentage
19	B637-14	Green Mt. x Teton
20	B76-43	96-44 x 529-170
21	Pontiac	Triumph x Katahdin
22	Potomac	R. N. Y. x Katahdin
23	Progress	Nebr. Seedling
24	Satapa	Minn. Seedling
25	Waseca	Minn. Seedling
26	Chisago	Minn. Seedling

Pa. table 2. U. S. Department of Agriculture Seedlings and named varieties in the wart-susceptible test and yields--harvest record Date: September 18, 1950.

Row No.	Variety or seedling	Hills	Hills warted	Yield	Vine growth & maturity	Check Hills	Check Hills warted	Check Yield	Check Vine Growth & maturity
		No.	No.			No.	No.		
1	Virgil	10	9	V. good	Excellent - late	10	10	Good	Good - Late
2	Chenango	8	8	V. poor	" "	10	10	"	" "
3	Snowdrift	10	10	V. good	" "	10	10	Fair	" "
4	Essex	6	2	Poor	Good - late	9	8	Good	" "
5	Ashworth	10	10	V. good	" "	10	7	"	" "
6	Placid	10	8	V. good	V. " "	10	6	Good	" "
7	Kennebec	10	0	Good	Very good - late	10	7	Fair	" "
8	Teton	9	8	Fair	Good - late	10	3	Fair	" "
9	Calrose	10	0	V. poor	Very good - late	10	8	Good	" "
10	Marygold	10	8	Fair	Fair - late	10	7	Fair	" "
11	Seneca	10	10	V. good	Good - medium late	10	10	Good	" "
12	Ontario	10	0	Good	" - late	10	8	Fair	" "
13	X927-3	10	10	Fair	" "	10	9	"	" "
14	B73-10	10	0*	V. good	" "	10	4	Good	" "
15	B73-16	10	1	Good	Fair - medium late	10	6	"	" "
16	B402-1	10	0	Fair	" early	10	5	"	" "
17	B294-22	10	0	Good	" med. late	10	7	Poor	" "
18	B355-44	10	4	Good	Good - late	10	5	Good	" "
19	B637-14	9	9	V. good	Good - late	10	5	Fair	" "
20	B76-43	10	6*	Fair	Fair - med. early	10	6	"	" "
21	Pontiac	10	2	V. good	V. good - late	10	4	Fair	" "
22	Potomac	10	7	Fair	" " "	10	5	Poor	" "
23	Progress	10	4	Good	Good - med. late	10	10	Fair	" "
24	Satapa	10	4	V. poor	Fair - early	10	5	Fair	" "
25	Waseca	10	8	Fair	" "	9	9	Good	" "
26	Chisago	10	0	Good	Good - med. late	10	9	Good	" "

* Wart Resistant

Pa. table 3. Wart reaction for newer potato varieties

Wart susceptible	Wart immune
Chippewa	Katahdin
Sebago	Sequoia
Houma	Pawnee
Pontiac	Ontario
Dakota Chief	Kennebec
Canus	Warba
Progress	Red Warba
Marygold	Calrose
White Pontiac	Mohawk
Menominee	Chisago
Seneca	Mesaba
Pungo	
Kasota	
Teton	
Potomac	
Erie	
Waseca	
Satapa	
Norkota	
Earlaine	
Earlaine #2	
Empire	
Chenango	
Essex	
LaSalle	
Desota	
Virgil	
Snowdrift	
Ashworth	
Placid	
Fillmore	

PENNSYLVANIA

W. R. Mills

This program is devoted to the production of blight-immune potatoes, with somewhat less emphasis on resistance to scab and virus diseases. All crosses and blight inoculations, as well as preliminary selections and yield tests, are made at State College. Hybrids that show promise through one or more replicated yield trials at State College are placed in yield trials in five or more different locations in the State, in comparison with standard varieties.

Rigid selection for blight resistance is made in the greenhouse, inoculating segregating seedling families with the appropriate races to eliminate susceptible seedlings before transplanting them to the field. Thereafter, one or more plants, grown from tubers of each variety saved, are tested with several races.

Practically every tuber planted in the field is first indexed in the greenhouse, as virus spread is usually very rapid at State College. All plantings are made in tuber units and roguing is practiced throughout the season.

Regional trials are made in cooperation with various extension departments, including plant pathology, entomology, agronomy and agriculture economics. The varieties are planted in the fields of selected growers where they are sprayed and otherwise handled as a part of the large field.

In 1950, blight first appeared in the breeding plot at State College about August 1, and gradually killed the susceptible varieties such as Katahdin and Russet Rural by about the middle of September. Not until the last of September was there any noticeable development of races other than the field race originally present. At that time, many seedling transplants began to blight, and by October 5, when a killing frost occurred, the majority of 6,000 transplants showed some blight. Numerous fungus isolations were made, yielding races B, C. D, and BD, in addition to the field race (race A).

Testing, now in progress, of somewhat over 300 seedlings selected from the plot, reveals that most of the selections recorded as blight-free in the field are immune to all of the above races.

A summary of yields and specific gravity of 15 varieties (5 locations) is given in Pa. table 1. Also included is the average yield for the past 3 years. Specific gravity data were taken by J. S. Cobb of the Department of Agronomy.

Pa. table 1. Yields per acre and specific gravity of 15 varieties in 5 counties in Pennsylvania in 1950.

Variety	Yield 1950		3-year ave. yield		1950
	Total	U.S. #1	Total	U.S. #1	Specific Gravity
	Bu.	Bu.	Bu.	Bu.	
Pontiac	695	571			1.060
2XJ-1	682	594	636	531	1.069
Ontario	681	558	604	503	1.063
3GR-8	671	464	---	---	1.078
Kennebec	662	492	640	481	1.073
Essex	657	508	656	513	1.066
3DA-1	642	473	---	---	1.068
Russet Rural	610	480	558	402	1.070
Teton	584	449	582	474	1.065
Madison	626	385	---	---	1.080
Katahdin	510	406	540	448	1.065
Cobbler	509	387	502	389	1.080
2TG-15	507	353	---	---	1.076
BP-7	486	383	505	407	1.069
Snowdrift	433	355	443	365	1.073

RHODE ISLAND

T. E. Odland and C. R. Skogley

In 1950 twenty-five varieties and seedlings were tested for yield at Kingston, R. I. The data for these tests are given in table 1. Ontario, Essex, Pontiac, and B69-16 significantly outyielded the standard Green Mountain. Fifteen of the twenty-five varieties yielded significantly less than the Green Mountain. Sequoia, Kennebec, Sebago, Teton, and Russet Rural were in the same class as the standard variety.

Flea beetle injury was absent only on the varieties B69-16, Menominee, and B355-44. Aphid damage was uniform and mild on all varieties, and no other insect damage was evident. Leaf roll was observed on B75-4, Mohawk, and B76-43. Five to fifteen percent late blight showed up on the varieties B75-4, Irish Cobbler, Earlaine, Mohawk, and B447-98. Early blight was evident up to 2 percent on the varieties Essex and Pontiac. Fusarium was found to the extent of 10 percent on the Essex variety. There was very little scab on the tubers of any of the varieties. Rhizoctonia was evident to a noticeable extent only on the varieties B75-4, Irish Cobbler, Earlaine, Pontiac, and B447-98. Growth cracks were noted on the varieties Progress, B75-4, and Erie.

Rainfall during the 1950 growing season at Kingston was near average and fairly well distributed throughout. The fertilizer used was 5-10-10 with mg. at the rate of 2,000 pounds per acre. The crop was planted on April 24 and harvested on August 18, 22, and September 21. Yields were calculated from 32-foot rows, replicated 4 times.

Rhode Island table 1. Yield and other data on 25 potato varieties grown at Kingston, R. I. - 1950

Variety	Yield U. S. No. 1 tubers per acre	Specific gravity 1.0 + .001X	Days to maturity	Tubers Size	Tubers Shape
	Bu.	Pct.		No.		
Ontario	608	97	72	138	Large	Smooth regular
Essex	594	97	65	131	Large	Smooth regular
Pontiac	577	98	64	130	Large	Smooth regular
B69-16	545	98	71	136	Large	Smooth regular
Sequoia	523	98	70	145	Large	Medium rough regular
Kennebec	503	98	71	137	Medium	Smooth regular
Green Mt.	501	97	80	136	Medium	Medium rough regular
Sebago	494	97	71	145	Large	Smooth regular
Teton	490	96	70	129	Medium	Medium rough regular
Russet Rural	487	96	76	133	Large	Smooth regular
Houma	466	93	73	128	Medium	Smooth regular
Erie	443	93	69	137	Large	Smooth regular
Menominee	441	98	68	145	Large	Smooth regular
Chippewa	431	96	65	133	Medium	Smooth regular
B637-14	392	98	64	134	Large	Smooth regular
B76-43	388	98	69	130	Medium	Smooth regular
Mohawk	377	99	75	137	Large	Smooth regular
I. Cobbler	369	92	76	110	Medium	Medium rough regular
1276-185	360	96	68	123	Medium	Smooth regular
Katahdin	357	96	66	132	Medium	Smooth regular
B355-44	338	97	71	142	Medium	Smooth regular
Earlaine	325	88	66	105	Medium	Smooth regular
Progress	316	76	68	132	Small	Smooth regular
B447-98	292	79	70	105	Medium	Medium rough regular
B75-4	259	93	75	197	Medium	Smooth regular

SOUTH CAROLINA

William M. Epps[1/]

The 1950 season in South Carolina was generally unfavorable for the growth of potatoes. February was warm and dry, so plants began to emerge ahead of schedule. Several frosts in late March and as late as April 16 severely burned the potatoes, in some fields killing the vines after they had begun to flower. April and May were very dry, so the plots suffered from a lack of water. The early varieties, such as Cobbler, Bliss, and Chippewa, failed to come back after the frost, and yields were low. Sebago came back remarkably well, and, for the first time since it has been grown in South Carolina, produced higher yields than the other commonly grown varieties. Late blight was not present in any of the test plantings. Four varieties and two seedlings were planted in replicated yield trials at three locations in addition to the planting at the station. Yields are reported in S. C. table 1.

S. C. Table 1. Yields of potatoes included in replicated trials in Charleston and Beaufort Counties, S. C., 1950

Variety or Seedling	Location and yield per acre of No. 1 size A potatoes				
	Station	Maryville	Meggetts	Burton	Average
	Bu.	Bu.	Bu.	Bu.	Bu.
Sebago	201	258	367	372	299
B73-10	229	158	336	421	286
Kennebec	231	150	391	323	274
B61-3	179	121	407	302	252
Katahdin	182	126	342	260	228
Cobbler	160	122	362	244	222
B69-16	289				
B73-3	219				
B76-23	232				
LSD 5%	30	44	93	50	
1%	40	60	126	68	

Three additional seedlings were included in the station trials.

The unusual yield of Sebago in the Maryville test cannot be explained. This plot area suffered severely from frost and drought, and the Sebago produced by far the highest yield in all six replicates of a 6 x 6 Latin Square test.

B76-23 was the most attractive of the three new seedlings. It has the slightly russeted skin so common on many of the scab-resistant seedlings. B69-16 and B73-3 also looked good.

South Carolina growers washed and dried most of their crop in 1950. Sebago appears to be the only one of the commonly used commercial varieties that is adapted to this process. Cobbler is too rough. Katahdin is smooth and white,

---

1/ The Kennebec shipping test was conducted partially by L. J. Kushman of the Division of Fruit and Vegetable Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, U. S. Department of Agriculture.

but turns brown quickly when skinned. Sebago is smooth, shallow-eyed and white, and will stand considerable punishment without turning brown.

Tests were conducted with the Kennebec variety in 1950 to determine its adaptability to the washing program. Two adjacent plots of Kennebec and Sebago were harvested on the same day. Both lots were handled alike and were washed in the same machine. Test samples were shipped in standard non-refrigerated truck loads to New York and Chicago, bags of each variety being placed at three locations in each truck. The test lots were examined upon arrival and again after storage at room temperature for 4 days at New York and 7 days at Chicago.

Reports from the inspectors (S. C. Table 2) indicated that both varieties arrived at the market in a salable condition but that the Kennebec did not carry as well as the Sebago.

S. C. Table 2. Shipping test results with Kennebec and Sebago potatoes shipped by truck from Charleston, S. C. to New York and Chicago. June 1950. (All data expressed in percentages)

*Variety & Sample	Inspection	**New York				**Chicago		
		Soft Rot	Shriveled	Browning Severe	Browning Slight	Soft Rot	Injuries	Browning
		Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
Kennebec 1	First	0.0	0.0	49.0	28.4	4.8	4.0	30.0
	Second	31.2	.0	28.6	10.1	6.0	2.0	40.0
Sebago 4	First	.0	.0	21.2	22.1	.0	.0	4.0
	Second	10.8	1.2	13.6	10.1	.0	.0	10.0
Kennebec 2	First	.5	.0	8.8	19.4	.8	4.0	12.4
	Second	1.7	3.9	14.7	14.1	8.0	6.0	18.0
Sebago 5	First	.0	.0	.5	.6	.0	.0	1.2
	Second	.0	6.4	2.7	8.2	.0	.0	4.0
Kennebec 3	First	.0	.0	.4	12.7	.0	6.0	24.0
	Second	.4	3.6	8.0	18.7	1.6	3.2	30.0
Sebago 6	First	.0	.0	.0	1.4	.0	.0	.0
	Second	.0	3.8	.9	11.8	.0	2.0	8.0

*Sample 1 and 4 located just behind front ventilator of truck one on each side.
2 and 5 located near center of truck in top tier.
3 and 6 located near center of truck in middle of load.

**First inspection upon arrival. Second inspection after 4 days storage in New York and 7 days storage in Chicago both at room temperature.

The Kennebec browned, scalded, and decayed more than Sebago in transit and both varieties were badly damaged near the front ventilator of the truck. The Kennebec was not as white and clean in appearance as the Sebago when it emerged from the washer.

Samples were also sent to Beltsville for chipping tests, since over half the 1950 S. C. crop was sold to chippers. The samples were divided and stored at temperatures of 50°, 60°, 70°, and 85°F. Small samples were removed and made into chips at intervals. Data are shown in S. C. Table 3.

S. C. Table 3. Color of potato chips made from South Carolina Kennebec and Sebago potatoes and stored under various temperatures.*

Variety	Days in Storage	Stored at			
		50°F.	60°F.	70°F.	85° F.
Kennebec	3	65	70	70	80
Sebago	3	75	80	75	80
Kennebec	7	55	65	70	80
Sebago	7	60	70	75	80
Kennebec	12	50	70	70	80
Sebago	12	60	75	70	80

* A color rating of 80 is the desired light golden brown. A rating of 70 indicates a barely salable product and chips rating less than 70 are too dark and are considered unsalable. Kennebec upon arrival produced chips with a rating of 80; Sebago 90, which is a very light golden color.

These results indicate that Kennebec is satisfactory for chips if the potatoes are stored at a fairly high temperature (85°F.). Kennebec and Sebago produce salable, but slightly dark chips when stored at 60° or 70°. Neither variety produced salable chips when stored for 7 days or more at 50°. Sebago chips were lighter and of a better color than Kennebec chips when both varieties were stored at these lower temperature levels.

VIRGINIA (Blacksburg)
Flood Andrews

Project title: A study of production of Irish potato seed stock in southwest Virginia.

Project leader: Flood S. Andrews.

Importance of the problem: Over a million bushels of seed potatoes are purchased annually in Virginia from outside sources. If satisfactory seed stock could be grown economically in southwest Virginia, it would provide the possibility of developing an industry among our southwest Virginia farmers who are interested in additional or new sources of income.

Object: To determine the relative merits of Virginia-grown potato seed stock and northern-grown seed stock (certified or equivalent) with respect to stand and yield when grown at Blacksburg, Va., and in eastern Virginia.

Plan of work: Seed stock of the following varieties will be obtained from Maine through the United States Department of Agriculture and from locally grown sources: Sequoia, Pontiac, Sebago, Chippewa, Kennebec, Cobbler, and Katahdin.

Each variety will be grown according to recommended practices in randomized replicated plots at Blacksburg and at the Virginia Truck Experiment Station, or in eastern Virginia.

Data will be taken on the time of come-up, the stand, and the yield of U. S. #1 and total yield.

Location: Seed stock will be grown at Blacksburg, Va., and tested for yield at Blacksburg and Norfolk, or at Warsaw, Va.

Results to date: No consistent differences have been found between Virginia-grown seed stock and Maine-grown. The results of this test for 1950 are shown in Virginia table 1.

Pungo (B 76-23), a variety recently released jointly by the Virginia Truck Experiment Station, Norfolk, Va., and the United States Department of Agriculture, was tested for yield at Blacksburg, Va., in comparison with Teton and six numbered varieties (Virginia table 2).

B 69-16 outyielded all other varieties significantly except Teton. Pungo yielded almost as much as Teton, as did also B 355-44. Pungo and B 355-44 were in the same class in yield as B 73-10, if the least significant difference at the 5-percent level is considered. B 73-10 is a blight-resistant variety that is preferred to Pungo by a number of the southern workers. B 355-44 is resistant to both late blight and ring rot.

Virginia table 1. Yields and percentages of U. S. No. 1 potatoes from seed stock grown at Blacksburg, Va., and from seed stock grown in Aroostook County, Maine.

Variety	Seed source	Mean yield U.S. #1 per plot	U.S. No. 1
		Lb. 1/	Pct.
Sequoia	V.P.I.	69.5	84
"	Maine	87.2	94
Pontiac	V.P.I.	48.8	85
"	Maine	59.9	88
Sebago	V.P.I.	49.6	84
"	Maine	60.0	92
Chippewa	V.P.I.	Poor stand	--
"	Maine	" "	--
Kennebec	V.P.I.	37.3	85
"	Maine	72.7	92
Cobbler	V.P.I.	40.8	85
"	Maine	49.7	86
Katahdin	V.P.I.	59.5	79
"	Maine	52.9	90

1/ Mean of 6 rows of 30 hills each, planted 12 inches apart in the rows and the rows 30 inches apart.

Virginia table 2. Yields and percentages of U. S. No. 1 tubers of Pungo, Teton, and six numbered varieties.

Variety number of name	Mean yield U. S. No. 1 per plot	U. S. No. 1
	Lb. 1/	Pct.
Pungo (B 76-43)	58.2	88
Teton	63.7	93
B 69-16	75.2	89
B 73-10	47.4	85
B 75-4	30.7	91
X137-5	19.2	75
B355-44	59.2	84
X1276-185	26.2	86
L.S.D. 5% level	15.0	

1/ Mean of four rows of 30 hills each planted 12 inches apart in rows, and the rows 30 inches apart. The seed was obtained from M. M. Parker, Virginia Truck Experiment Station, Norfolk, Va.

VIRGINIA

M. M. Parker

For more than 50 years eastern Virginia has been producing potatoes for the second early markets. Plantings reached a peak of more than 100,000 acres of this crop in the four or five coastal counties, and all farming activities in three of the counties centered around it. At that time the most productive land was reserved for potatoes and its fertility was guarded by suitable rotation systems, the use of winter cover crops, and the application of liberal amounts of stable manure. This treatment on the sandy loam soils of these counties resulted in the production of a bright-looking, high-quality tuber, whose appearance caused them to be classified as "new" potatoes, as differentiated from the storage potatoes of the North, and which readily found receptive and widely scattered markets in June and July. Currently, the planted acerage is about 25,000 acres and is beset with strong competition from other producing areas whose yield may be better than the ones here because of their controlled growing conditions. The present problem, therefore, is to find more efficient means of producing and marketing the local crop. This could conceivably be done through an improvement in varieties, a more reliable method of getting large unit yields, and by using more effective marketing procedures.

Plan of work. Although we are in an area where excellent table stock may be produced we find it extremely difficult to grow satisfactory seed stock, and most of our breeding efforts are therefore confined to the planting and selection of seedling lots obtained from other parts of the country through the agencies of the National Potato-Breeding Program. Since we are also in an area where the soil types, climatic conditions, farming practices, and marketing possibilities of the crop apparently are most favorable for the production of early-maturing varieties, we prefer to first select for this quality. Sought for companion qualities are an appearance which makes the tubers acceptable to buyers, and edible characteristics which will appeal to the consumer. Naturally the value of such a variety is enhanced to a producer if it is inherently capable of being grown at a low unit cost of production and also if it carries resistance to some of the more serious potato diseases.

Under our present plan, three plantings are made. One at Norfolk on a fairly heavy kind of soil, not typical of the soils used to grow the very early commercial potatoes in this section, but a type that is capable of producing optimum yields. A second and duplicate planting of the first is made on a fairly representative potato soil at Onley, Va., and a third planting again at Norfolk for a very late crop to be harvested in early November.

The early planting at Norfolk is grown under irrigation, and every attempt is made to keep the soil moisture content at a point suitable for the best growth of the plants. This is done to bring out the inherent yielding capacity of the different kinds and to get a comparison of their time of maturity. The companion planting at Onley is not irrigated and of course

grows under different conditions of air temperature and soil moisture each year of the test. This results in information about a variety's ability to consistently perform well under all kinds of growing weather and points out those that might be more adaptable to our weather and soil conditions. The late summer planting at Norfolk is used to determine varietal resistance to late blight, which is very destructive not only to a crop grown in eastern Virginia at that time of the year but also to all potatoes grown in the interior parts of the State. This disease also seems to be becoming increasingly more destructive to the early crop in eastern Virginia. We are therefore trying to forestall its further development by selecting blight-resistant kinds that mature soon enough to fit into the early potato production practice of this section.

1950 seedling lots. Seventeen seedling selections were obtained from the National headquarters and were planted for the 1950 trials. Ten of the lots had been classified as early maturing, three medium maturing, and the remainder late. Fifteen were said to carry resistance to blight, and two resistance to scab. The trial was conducted primarily to obtain data on the shape and appearance of the tubers so that the lots could be classified and listed in the order of their desirability. Records were taken of the yields of these 17 lots but since they were not planted in replicate, yields are indicative only. Also, the planting was made somewhat later than usual, which resulted in a low yield as a whole but which did not apparently affect the comparative yielding ability of any one lot.

Results. The bright appearance, smoothness of outline, and uniformity of size caused us to place lot B313-21 at the top of the list as our first choice of the 17 different kinds. (Virginia table 1). It was also the

Virginia table 1. Irish potato seedling lots arranged in order of their yield, Onley, Va., 1950.

Seedling No.	Parentage	Maturity	Characters	Yield per A.
				Bu.
B 313-21	Sequoia x 96-56	Early	Blight res.	280
B 2098-3	Mohawk x B 355-24	Medium	do	265
B 639-12	B 76-43 x 46952	"	do	231
B 278-27	Gr. Mt. x 96-56	Early	do	227
B919-13	B355-24 x 792-94	"	Blight & ring rot res.	221
B 355-44	96-56 x Saranac	Late	do	193
B 73-16	Mohawk x 96-56	"	Blight res.	173
B 738-17	Katahdin x B 61-3	Early	do	165
B 447-98	96-345 x Saranac	"	do	155
B 920-7	B 401-3X B 355-24	"	Scab & Blight res.	145
B595-187	41956 x B 61-3	"	Blight res. & X immune	140
B 294-65	Houma x 96-56	"	Blight res.	117
B 905-1	927-3 x B 192-12	Late	do	112
B 2130-1	B56-1 x B 580-20	Medium	Scab res.	97
B 759-26	B 38-16 x B 402-1	Early	do	70
B 962-1	B 81-40 x 245-186	"	Scab & blight res.	58
B 991-6	B 355-24 x B 81-40	"	do	43

leader in yield, but as mentioned earlier these data were obtained from non-replicated plots, and possibly its yield might not be significantly better than that of some of the others. Its reputed earliness also appealed to us.

Our second choice was B 919-13. This seedling gave a somewhat lower yield than that of several other kinds, but it was very similar in appearance to B 313-21. In addition to the blight resistance factor, it also was said to be resistant to ring rot.

Lots B 639-12, B 73-16, B 278-27, and B 2098-3 were quite acceptable insofar as their appearance was concerned, but in our opinion were inferior to both B 313-21 and B 919-13. Even though B 2098-3 placed in the preferred list it produced rather small potatoes, and it is highly probable that this one would fail to make sufficiently large tubers if the planting encountered adverse growing conditions. We therefore placed it at the end of the list of the more desirable kinds.

The performance of B 355-44, B 738-17, B 447-98, B 920-7, B 595-185, B 249-65, B 905-1, B 2130-1, B 759-26, B 962-1 and B 991-6 was considered to be inferior to the earlier mentioned kinds both in the appearance of the tubers and in yielding ability. They are therefore grouped into one class. However it is conceivable that some of them might be adaptable to growing conditions in other parts of this State and might therefore make a better showing elsewhere.

The first-mentioned five, B 693-12, B 919-13, B 313-21, B 73-16, and B 278-27, should, in our opinion, be subjected to further trials and on a more comprehensive basis of yield, rate of maturity, resistance to disease, and edible properties. Additional and widespread tests would undoubtedly quickly establish or disqualify some of them for propagation purposes.

Performance of new and old varieties. In general the trend and order of yield from the named varieties in 1950 was similar to that in the past. The late-maturing varieties, with a few exceptions, gave the largest yields, and since blight was not destructive on the 1950 spring crop there was no particular difference in the yield from blight-resistant varieties as a group compared with the non-resistant ones. Kennebec, under non-irrigated conditions again was the highest-yielding one, but it was closely followed by Pontiac which always has been a high-yielding variety under conditions where it was not attacked by blight. (Virginia table 2). Essex, due to a lack of sufficient soil moisture, was this year again unable to "size-up" the large number of tubers set per plant, thus it placed about half way in the list of yields. Under irrigation or when sufficient seasonal rainfall occurs this variety is potentially the best-yielding named variety. Katahdin also is one of the consistently good-yielding kinds. It is used to some extent in commercial plantings along the coast of Virginia, but it has never become well established, possibly because of its lateness in Maturity. Sebago is looked upon here with more favor than most other late-maturing ones because it may be grown in the lower darker soils, and when being washed it makes a nice, white appearance capable of competing in looks with the early varieties grown on the lighter soils that naturally produce a good-looking potato. The Sebago in most of our trials has produced somewhat better yields than the Cobbler but in some commercial plantings it has not always been superior.

Virginia table 2. Irish potato named varieties arranged in order of their yield Onley, Va., 1950.

Variety	Parentage	Maturity	Characters	Yield per A.
				Bu.
Kennebec	B 127 x 96-56	Late	Blight res.	295
Pontiac	Triumph x Katahdin	"	High yield	285
LaSoda	-	"	-	273
Katahdin	-	"	-	247
Marygold	45208 x Earlaine	"	High yield	225
Sebago	Chippewa x Katahdin	"	Blight & yellow dwarf	220
Essex	-	"	Blight res.	217
Cobbler	-	Early	-	195
Teton	45146 x Earlaine	Late	Ring rot res.	173
Canus	G.S. 9-11 x 24642	"	High yield	135
Red Warba	-	Early		128

It is evident from these and other trial plantings here in the past that the early-maturing varieties are most suitable for spring production in eastern Virginia, and they do best when they are planted as early as possible in the planting season. Such is not the case, however, with the late crop planted during the latter part of July for November harvest. The length of the growing season from July on is slightly more than 100 days. Yet, because of the quick hours of daylight and cooler temperatures, the late-maturing kinds produce tubers large enough to harvest in less than 100 days from planting. The late crop, however, is nearly always devastatingly attacked by late blight each year and blight-resistant kinds are essential. It is possible that other varieties could be developed for late crop plantings, but the Kennebec variety, even though it is too late for the spring crop, seems at present to have all of the characteristics necessary to make a satisfactory second crop of potatoes possible in eastern Virginia.

WASHINGTON

S. B. Locke and A. E. Rich

Project Title: Virus Diseases of Potato and Other Solanaceous Plants.

Project Leaders: S. B. Locke, Department of Plant Pathology, and A. E. Rich, Department of Plant Pathology

Importance of the Problem: Since 1944 the project has had for one of its chief aims the testing of varieties for resistance to field infection with leaf roll virus. Prior to 1938 leaf roll was considered a minor potato disease in Washington. Since that time it has become a major one. In 1945 nearly all of the potatoes grown for certification in northwestern Washington were rejected because of leaf roll infection, and the Netted Gem variety, grown in the commercial production areas of central Washington failed because of rapid current-season spread of the disease and the resultant great amounts of net necrosis developing in the tubers.

Objects: In cooperation with Dr. C. L. Vincent of the Department of Horticulture, it is the aim of the project to test old and new varieties and unnamed seedlings as they appear for adaptation to Washington conditions and for field resistance or susceptibility to leaf roll infection and development of net necrosis.

Plan of Work: The best seed available is obtained each year and planted in 25-hill plots, replicated 4 times in randomized blocks at each of 3 representative locations in the State. Rows of leaf roll infected potatoes are planted in the plots in order to supply inoculum for field spread. These plots are sampled at harvesttime, and the samples are planted the following season to determine the amount of increase in leaf roll infection that has taken place during the season of exposure.

Location:: The leaf roll exposure plots are located in northwestern Washington where the main potato seed production is located; in central Washington where the main commercial production is located; and in eastern Washington where the secondary potato seed production is located.

Results to Date: No leaf roll immune varieties have been discovered. The greatest resistance to field infection so far observed occurs in X1276-185 (obtained from Dr. D. Folsom), Calrose, and Katahdin. The variety Madison shows promise in this direction, but data for one season only are available. Of special interest to us is the variety Essex which has been moderately resistant to leaf roll infection, and in addition was highly resistant to late blight in western Washington in 1950, and is a heavy yielder under our conditions. Counts made at Pullman during the last four seasons failed to show a relationship between resistance to leaf roll and aphid populations occurring on different varieties.

The data for percentage increase in leaf roll infection of potato varieties in the field at four locations in the State of Washington for 1949 are given in Washington table 1. Washington table 2 gives the data on varietal resistance to late blight at Mount Vernon, Wash., in 1950.

Washington table 1. Percentage increase in leaf roll infection of potato varieties in the field during 1949.

Variety	Percentage leaf roll infection and location			
	Northwestern Wash. (Mt. Vernon)	Central Wash. (Prosser)	Eastern Wash. (Pullman)	Average of three locations
	Pct.	Pct.	Pct.	Pct.
Ashworth	32.3	87.5	29.7	49.8
Calrose	.9	5.5	13.5	6.6
Chenango	35.5	88.5	46.9	56.9
Essex	1.9	46.6	.9	16.5
Glen Meer 1/	11.8	30.9	38.4	25.7
Kennebec	93.5	86.5	7.0	62.3
LaSoda	28.8	71.7	21.7	40.7
Madison	.0	8.2	.0	2.7
Netted Gem	37.8	100.0	71.5	69.6
Ontario	19.4	74.0	44.8	46.1
Red Warba	18.5	47.4	9.4	25.1
Russet Sebago	1.9	89.7	8.2	33.3
Sebago	7.9	88.0	100.0	65.3
Snowdrift	53.3	89.7	16.2	53.1
Warba	33.9	60.6	19.9	38.1
White Rose	9.9	77.6	69.5	52.3
X 1276-185	8.5	.0	.0	2.5
Average	23.3	61.9	29.3	38.0

1/ Unreliable because of a large amount of rugose mosaic present in the seed.

Washington table 2. Varietal resistance to late blight at Mt. Vernon, Wash., expressed in terms of percentage defoliation of potato vines. September 20, 1950.

Variety	Defoliation of vines				
	Block I	Block II	Block III	Block IV	Average
	Pct.	Pct.	Pct.	Pct.	Pct.
Canago	30	20	10	20	20
Canus	95	90	50	70	76
Chenango	5	5	5	5	5
Columbia Russet	90	30	50	50	55
Essex	10	5	5	Trace	5
Dakota Chief	100	75	80	30	71
Katahdin	100	95	90	40	81
Kennebec	5	5	Trace	Trace	3
LaSalle	100	100	50	100	87
LaSoda	100	100	80	50	82
Mohawk	30	30	25	20	26
Menominee	5	10	Trace	5	5
Netted Gem	95	50	50	80	69
Ontario	60	10	10	10	22
Progress	100	100	90	20	77
Russet Sebago	15	10	10	15	12
Satapa	100	100	90	95	96
Selection A	Trace	0	0	0	Trace
Teton	60	50	80	75	66
Waseca	100	100	95	90	96
White Pontiac	95	70	80	40	71
Yampa	50	75	75	25	56
X 1276-185	75	100	100	70	86
B 505-44	75	25	40	35	44
B 754-16	50	50	60	50	52
B 579-3	100	100	75	40	79
Sebago	10	15	10	10	11

The varieties showing the most resistance were Selection A, Kennebec, Menominee, Essex, and Chenango. All five of these showed an average defoliation of 5 percent or less. Sebago and Russet Sebago showed, as was to be expected, an intermediate degree of resistance.

WASHINGTON

J. D. Menzies

A. Project title: Potato Leaf Roll Resistance Test

Project leader: J. D. Menzies

Importance of the problem:

The leaf roll virus disease has, in the last 20 years, become the major disease problem affecting the Russet Burbank potato in Washington. Even though almost the entire commercial acerage in the irrigated areas is planted with certified seed, leaf roll is so general that the resulting net necrosis causes severe losses. Early current-season infection is common and also causes significant yield reduction. Cooperation in the national potato-breeding program for leaf-roll resistance was undertaken in 1947 as one approach to a solution of the problem.

Objects:

1. To discover a leaf roll resistant clone of potatoes that is otherwise good enough to replace the Russet Burbank as a late potato for Washington.

2. In quest of the above, to cooperate in testing seedling lines, from Beltsville and elsewhere, for field resistance to leaf roll so that resistant family lines for further breeding projects can be identified.

Plan of Work

Seedlings from Beltsville or other breeding stations are tested in field-exposure plots wherein sources of leaf roll and uncontrolled aphid vectors are provided. Occurrence of chronic or current-season leaf roll in any plants of a clone is sufficient to cause its rejection when less than 50 plants are exposed. Trace infections in larger plantings are temporarily accepted, and such clones if saved for 3 or more years are placed in comparative trials conducted by Vincent and Locke of Washington State College. No crosses are made locally at present.

Location:

Irrigation Experiment Station, Prosser, Washington.

Results to Date:

Results prior to 1950 have already been reported.

1950 results:

Of a group of 3,589 seedlings put under field-exposure tests 3 years ago only 29 are still being saved as leaf-roll free. These were exposed as single hills in 1948, as 10-hill clones in 1949, and as 50-hill clones in 1950. Originally 83 crosses were represented in this group of seedlings. One of the objectives was to find, if possible, family lines that tended to produce leaf roll resistant progeny. This objective was apparently not attained. Last year there seemed to be a tendency for clones derived from B522-33 or X1276 to have high chances for survival. That this is not true for the latter is shown by the fact that 23.3 percent of the original seedlings had X1276 parentage and 20.7 percent of the 29 survivors this year are from this group. There has been some evidence that B522-33 clones are being concentrated by the leaf roll elimination, but the magnitude is low. Thus, with 19.3 percent of this type in the original lot this year we have 37.9 percent. Even if all the seedlings saved this year are considered to be field resistant it would mean that only 1.5 percent of the B522-33 progenies are in this class. There has been no roguing of undesirable agronomic types from this material.

A number of other seedling clones were re-tested for leaf-roll resistance in 1950. All were eliminated because of chronic or current-season infection except B579-3. This seedling was introduced to our test in 1947. Some leaf roll was recorded in 1947 and 1948, but samples were taken from all hills for the 1949 planting in which no chronic or current leaf roll was found. Mass selection from 300 hills in 1949 provided seed for 300 hills in 1950. Again no leaf roll could be identified. The last 2 years tests have been in comparison with Russet Burbank which has shown 60 to 90 percent infection annually. B579-3, therefore, may have field resistance. It also is a promising variety from other standpoints and will be tested in larger plots next year.

B. Project title: Yellows-type virus of Potatoes in Washington State.

Project leader: J. D. Menzies

Importance of Problem:

Apparently not of great economic importance at present. The reason for investigating these diseases is that in the leaf-roll project it has been difficult to make accurate diagnosis of leaf roll. One or more other viruses produce symptoms which, both in the current and chronic stages, are confused with leaf-roll. Until these were better known it was not possible to be sure how much error was present in the leaf-roll records. There is also a tendency in the industry to identify leaf roll as something else which interferes with leaf-roll control programs and leads to confusion.

Objects:

To find out what other viruses are pressnt in the leaf-roll test plots and study their symptoms and characteristics so that they can be accurately distinguished from leaf roll.

Plan of work:

Collections of affected plants are taken to the greenhouse for study. Tomatoes are being successfully used as indexing hosts by means of graft transmission. Dodder is being used for transmission tests to non-Solonaceous hosts.

Location:

Irrigation Experiment Station, Prosser, Washington.

Results to date:

Two viruses other than leaf roll have so far been isolated from affected plants where field diagnosis has been questionable. One, which appears to be identical to green-dwarf, causes a severe dwarfing on tomatoes and peppers which closely resembles the curly-top disease. It also closely resembles bunch-top of potatoes as described in New Brunswick. The other, when transmitted to tomato, produces the big-bud disease. This in turn has been transmitted by dodder to aster producing symptoms of aster yellows. On potatoes the latter disease produces symptoms similar to purple top, also shown to be due to aster yellows, at least in certain cases. By correlating field symptoms on potatoes with the tomato indexing a more accurate separation of these diseases is now being made. Leaf roll accounts for about 90 percent of the cases tested which indicates that previous records are not greatly in error.

A summary of survival of potato seedlings in field-exposure test vs. leaf roll at Prosser, is given in Wash. table 1.

Wash. table 1. Summary of survival data on potato seedling in field-exposure tests vs. leaf roll, Prosser, Washington, 1950.

No.	Pedigree	Seedlings saved			
		Orig. 1947	1948	1949	1950
		No.	No.	No.	No.
B1025	Sebago x X247-48	36	16	0	-
1026	B24-76 x B24-238	173	109	7	3
1028	X247-44 x B61-3	104	86	2	-
1029	X1276-179 x X247-48	167	112	1	-
1030	X1276-185 x Katahdin	85	45	3	1
1031	X1276-185 x X96-56	179	125	2	1
1038	X792-94 x X157-9	102	41	2	-
1171	B401-3 x B401-3	1	--	-	-
1203	B247-48 x B247-48	22	13	3	2
1204	B750-10 x B750-10	20	13	1	-
1205	B294-38 x B294-38	3	--	-	-
1206	B401-3 x B401-3	16	5	2	-
2029	Earlaine x Triumf	23	18	0	-

Wash. table 1 continued

No.	Pedigree	Orig. 1947 No.	Seedlings saved 1948 No.	1949 No.	1950 No.
B2030	Houma x Katahdin	33	7	-	-
2031	Houma x 792-94	36	12	-	-
2033	Katahdin x Triumf	54	28	2	-
2034	Starkeragis x X157-9	7	4	0	-
2035	Sebago x X157-9	7	2	0	-
2037	Sebago x I1241-90	50	23	0	-
2038	Shamrock x I1241-90	54	29	4	3
2039	X245-186 x X157-9	53	20	0	-
2040	X247-44 x Katahdin	65	29	1	-
2041	X750-10 x X247-48	114	70	6	3
B 2043	XI1241-90 x X247-44	70	26	1	-
2044	I1241-91 x X247-48	52	10	-	-
2045	I1241-90 x Triumf	82	46	6	1
2046	X1276-48 x I1241-90	66	9	3	2
2047	X1276-48 x I1241-91	28	5	0	-
2048	X1276-48 x B24-238	53	24	8	2
2049	X1276-48 x Katahdin	72	26	0	-
2050	41956 x X247-42	27	14	0	-
2051	46952 x Triumf	44	17	2	-
2052	B24-50 x Katahdin	52	20	1	-
2053	B24-76 x Katahdin	97	34	2	-
2054	B24-78 x B24-58	18	3	0	-
2056	B71-4 x X157-9	33	11	-	-
2057	B81-40 X X157-9	15	6	-	-
2058	B192-12 x X157-9	26	10	-	-
2059	B488-7 x X157-9	21	2	-	-
2060	Sebago x B401-3	3	--	-	-
2061	Houma x Katahdin	0	--	-	-
2062	Houma x B401-3	18	14	1	-
2063	Houma x B522-33	9	4	-	-
2064	X1276-185 x B401-3	51	35	-	-
2200	Placid x B522-33	22	11	1	-
2202	Sebago x B401-3	30	17	0	-
2206	Skerry Champ. x B522-33	39	22	3	2
2209	B96-56 x B401-3	5	3	0	-
2211	B157-9 x B522-33	11	4	-	-
2213	B247-48 x 157-9	15	8	-	-
2214	B247-48 x B522-33	12	2	-	-
2215	B247-48 x Triumf	12	9	-	-
2217	B750-10 x B522-33	20	15	2	1
2218	B750-10 x Triumf	38	25	1	-
2220	B1276-185 x B522-33	24	6	0	-
2221	B1276-185 x B157-9	3	--	-	-
2222	B1276-185 x B401-3	30	10	1	-
2225	B61-3 x B401-3	22	5	-	-
2229	B204-13 x 157-9	10	2	-	-

Wash. table 1 continued

No.	Pedigree	Seedlings saved			
		Orig. 1947	1948	1949	1950
		No.	No.	No.	No.
B 2230	B294-33 x B522-33	20	6	1	1
2232	B294-38 x B522-33	33	10	-	-
2233	B294-38 x B157-9	18	1	-	-
2234	B401-3 x B157-9	16	6	-	-
2235	B401-3 x Triumf	49	27	-	-
2238	B446-54 x Triumf	26	16	-	-
2240	B522-33 x B157-9	20	7	-	-
2241	B522-33 x B247-48	20	5	-	-
2242	B522-33 x Triumf	11	8	1	-
2284	Erie x X247-48	51	35	-	-
2285	Houma x B401-3	21	8	1	-
2286	Houma x B522-33	14	9	2	-
2287	Katahdin x B522-33	52	30	2	1
2289	Sebago x B401-3	103	52	-	-
2290	Teton x X157-9	18	8	-	
2291	Virgil x B522-33	46	38	7	3
2292	B401-3 x Katahdin	52	25	-	-
2293	B401-3 x Triumf	21	11	1	-
2294	B401-3 x X792-94	68	39	-	-
2295	B522-33 x Triumf	41	33	3	-
2296	B522-33 x B355-44	21	18	1	-
2297	B522-33 x B445-41	26	10	-	-
2298	B522-33 x B594-46	61	31	4	-
2299	522-33 x X792-94	30	21	5	2
2300	41956 x B522-33	57	28	5	-
2301	X1276-185 x X157-9	17	9	2	-
2302	X1276-185 x B401-3	37	21	1	-
2303	X1276-185 x B522-33	25	14	3	1
2304	41956 x B401-3	43	17	-	-
2288	Placid x B 522-33	78	50	2	1

WASHINGTON

C. L. Vincent

---

1. Project title: The breeding and development of potato varieties.

2. Project leaders: C. L. Vincent, Division of Horticulture. Cooperating, Seth B. Locke, Division of Plant Pathology.

3. Importance of problem: Disease troubles of the Russet Burbank are so serious in all sections of Washington that it becomes necessary to obtain or develop a potato variety resistant to or immune from the troubles, mainly virus.

4. Objects: To develop and test varieties of potatoes adapted to the potato-growing regions of Washington, superior to existing varieties as related to: (1) Resistant to certain diseases, (2) quality, (3) yield, and (4) other desirable horticultural qualities, such as shape, eye depth, skin color, and season of maturity.

5. Plan of work: To obtain samples of untried potato varieties and new introductions for planting under dry-land conditions of eastern and western Washington. The Division of Horticulture is charged with breeding work and the obtaining of new breeding lines from U. S. D. A. and other agencies; to study growth habits, adaptability, yields, quality and commercial value of the tubers.

The Division of Plant Pathology is to assist in determining the value of breeding lines by determining their resistance to virus diseases in field and greenhouse plantings.

6. Location: Randomized plantings of four replications to be made each year at the main Experiment Station, Pullman, Irrigation Experiment Station, Mt. Vernon, and Northwest Experiment Station, Mt. Vernon, Washington.

7. Results: See Vincent table No. 1.

Potato-variety studies in 1950 were continued on the same basis as in previous years. Twenty-seven varieties were planted and each was replicated 4 times in 25-hill units. Every fifth row in the over-all plot was planted with leaf roll infected Russet Burbank, since a study of varietal resistance to leaf roll is one of the main considerations of the study. At Prosser the potato planting was irrigated as often as necessary to insure steady growth of the plants. At Pullman, in eastern Washington, and at Mt. Vernon, in western Washington, no additional water, over natural rainfall, was given the potatoes.

The highest-yielding varieties, based on the average yield of the three sections (see Vincent table 1) are Dakota Chief, Essex, Kennebec, Menominee, and Satapa. Essex has been outstanding in yields in the various sections of Washington since the first year of its introduction into plot plantings.

Vincent table 1. Yield test of potato varieties. Average of four replications at each location, 1950.

Variety	Place Grown						Av. total yield per A for 3 places	Av. yield No. 1 per A for 3 places
	Prosser, Wash.		Mt. Vernon, Wash.		Pullman, Wash.			
	Total yield per A	Yield No. 1 per A	Total yield per A	Yield No. 1 per A	Total yield per A	Yield No. 1 per A		
	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons
Canago	21.7	20.2	9.6	8.6	9.1	7.9	13.5	12.2
Canus	25.8	24.6	12.2	11.2	19.4	14.1	19.1	16.6
Chenago	18.2	15.0	9.1	6.3	12.2	7.9	13.2	9.7
Columbia Russet	22.4	21.0	15.5	14.1	15.1	12.4	17.7	15.8
Dakota Chief	31.7	31.2	18.2	17.5	15.6	14.0	21.8	20.9
Essex	30.1	29.3	18.1	17.1	15.6	10.6	21.3	19.0
Katahdin	26.1	25.4	10.8	10.4	10.2	8.2	15.7	14.7
Kennebec	28.0	27.5	18.0	17.1	15.8	14.6	20.6	19.7
LaSalle	15.5	14.8	9.5	8.3	11.3	9.0	12.1	10.7
LaSoda	16.7	15.9	11.1	10.5	15.9	12.7	14.6	13.0
Mohawk	21.2	20.7	11.7	11.2	12.5	10.2	15.1	14.0
Menominee	25.5	24.5	19.7	18.9	18.6	16.3	21.3	19.9
Russet Burbank	20.6	17.7	13.9	9.7	14.2	10.2	16.2	12.5
Ontario	26.9	25.5	17.1	16.7	12.8	10.5	18.9	17.6
Progress	22.0	20.3	14.8	11.7	15.2	12.2	17.3	14.7
Russet Sebago	21.4	21.2	9.9	8.9	10.6	8.3	14.0	12.8
Satapa	29.9	28.4	13.3	12.9	15.8	14.1	20.0	18.5
Sebago	23.8	23.1	13.2	12.5	9.8	8.7	15.6	14.8
Selection A	16.4	15.9	12.9	11.9	8.3	7.4	12.5	11.7
Teton	28.9	27.3	10.3	9.4	15.4	12.5	18.2	16.4
Waseca	22.8	22.5	9.2	8.2	16.3	13.8	16.1	14.8
White Pontiac	27.3	26.1	15.3	13.9	13.8	10.9	18.8	17.0
Yampa	20.8	19.7	13.2	12.1	14.4	10.4	16.1	14.1
X1276-185	21.0	20.6	8.2	7.5	10.0	8.8	13.8	12.3
B-505-44	26.8	24.9	14.7	12.7	10.3	8.7	17.3	15.4
B-579-3	18.0	17.5	9.2	9.2	9.8	7.9	12.6	11.5
B-754-16	16.5	15.6	9.8	9.1	8.0	6.7	11.4	10.5

Menominee, while a good yielder, is undesirable in tuber shape.

In addition to the above studies, 14 numbered varieties of potatoes were obtained from W. C. Edmundson, U. S. D. A., Greeley, Colorado, to be observed for scab resistance. Since only a few tubers of each selection could be obtained, in 1949 they were planted in multiplication plots; in 1950 all "C. S." varieties were grown in 25-hill units. At harvesttime the following were found to be highly resistant to scab: C. S. 7579, 5228, 8859, 8822, 9350, 8827, 9354, 6320, 7529, 7377, and 7570. C. S. 8780 showed light scab infection and C. S. 4716 and 9352 heavy scab infection.

The C. S. plots were established in Pullman on a Palouse silt loam soil.

WEST VIRGINIA

M. E. Gallegly

The major portion of the potato-growing area of West Virginia is located in high altitude valleys where heavy fogs and dews with inherent cool temperatures prevail. Because of this, late blight is an annual problem. This year the disease was more destructive than usual because of its early occurrence (July 5) and an unusually heavy rainfall. Consequently, better late blight control, by fungicides and by resistant varieties, dominates our present researches and will continue to be of primary consideration in the immediate future.

Late Blight

During the winter of 1949-1950, 95 single-hill selections from family lines B2346, B2352, B2421, B2433, and B2574, with promising horticultural characters, were tested for resistance to the common race of Phytophthora infestans. The plants were placed in a humidity chamber and sprayed with a suspension of sporangia and zoospores. After 5 days the plants were examined and given a disease-index rating of 0 to 4 based on the size of the necrotic area and the presence or absence of sprongiophores. From this, susceptible, slightly resistant, resistant, and highly resistant groups were differentiated. Representative individuals from each of the four groups were planted in the field during the summer and observed for their reaction to late blight. All plants classed as susceptible by the greenhouse test were susceptible in the field, while those classed from slightly to highly resistant were not visibly affected by the disease until a second strain of the parasite came in. All individuals were susceptible to this strain.

Of the 36 late-blight-resistant varieties planted in 10-hill units for observation, only B922 (resistant to the Beltsville blight races) showed resistance to the races of the fungus that were present. However, B922-10 and B922-12 showed a few sporulating lesions late in the season. Several isolates of Phytophthora infestans were obtained from the blight-resistant hybrids and experiments to identify them are now under way.

Two experiments were carried out in the Tygart Valley near Huttonsville, W. Va., to demonstrate to farmers the necessity of spraying with a fungicide, even though a late-blight-resistant variety is grown. In the first experiment yield and defoliation of several blight-resistant and susceptible varieties and seedlings when sprayed with bordeaux plus DDT were compared to that of the same varieties when sprayed with DDT alone. The results in W. Va. table 1 show that the yield of all varieties was higher when sprayed with bordeaux plus DDT than it was when sprayed with DDT alone. The late-blight-resistant varieties (R), in general, gave higher yields than did the susceptible varieties from both spray treatments. B446-8, a tall, vigorous, blight- and ring-rot-resistant seedling was the highest yielder of the group. Both early and late blight were present on most of the varieties in the DDT plot, while in the bordeaux plus DDT plots only the susceptible varieties were defoliated by late blight. Because blackleg almost totally destroyed the yield in one of

the replicates in the bordeaux plus DDT plots, the yield data were not subjected to analysis of variance.

W. Va. table 1. Defoliation and yield of several potato varieties and seedlings when sprayed with bordeaux plus DDT and DDT alone - 5 applications.

Variety or pedigree	Defoliation at 101 days after planting		Yield of U. S. No. 1 per acre	
	DDT	Bordeaux + DDT	DDT	Bordeaux + DDT
	Pct.	Pct.	Bu.	Bu.
B446-8 (R)	16.2	5.0	444	717
Chenago (R)	44-8	6.0	364	596
Ashworth (R)	38.8	6.0	328	566
Essex (R)	17.7	3.5	421	554
Sebago(SR)	93.5	19.0	294	511
Virgil (R)	10.3	3.5	393	509
Pungo (R)	60.3	10.3	391	503
Kennebec (R)	20.5	4.5	388	442
Sequoia	80.5	10.3	236	427
X96-44 (R)	93.0	54.3	350	412
Seneca	95.3	31.8	207	412
Teton	100.0	60.3	200	403
Cobbler	100.0	76.0	246	396
X96-56 (R)	76.8	36.0	365	390
B73-3 (R)	38.8	10.3	323	375
B62-1* (R)	92.0	23.3	225	366
Yampa	100.0	38.8	226	345
B75-4 (R)	94.8	54.3	278	342
B287-8	100.0	70.8	269	342
Katahdin	98.5	50.7	216	342
46952*	100.0	84.8	222	340
B637-14	100.0	44.8	234	339
X1276-185	100.0	75.3	142	252
LSD				
19:1	19.9	26.3	108.6	---
99:1	26.5	35.0	144.6	---

*Severe virus streak present - unidentified at present.

In the second experiment Kennebec, a late-blight-resistant variety, was sprayed six times with three different fungicides plus DDT and with DDT alone. The results are shown in W. Va. table 2. Yield and defoliation control was best when zineb (Parzate, Dithane Z-78, etc.) was used as the fungicide. Both early and late blight defoliated the control plots, while late blight was not observed on the fungicide-sprayed plots until 2 weeks after the final application.

W. Va. table 2. Yield and defoliation of Kennebec potato, a late blight resistant variety, when sprayed with three fungicides.

Fungicide	Defoliation at days after planting		Yield per acre	
	101	111	Total	U.S. #1
	Pct.	Pct.	Bu.	Bu.
Zineb 3-100	2.2	18.0	567	499
Tribasic $CUSO_4$ 4-100	2.5	31.9	521	466
Bordeaux mixture 8-4-100	2.4	26.5	521	457
None	33.3	97.0	396	335
LSD				
19:1	13.0	12.6	54.1	42.6
99:1	20.0	18.7	77.8	61.3

The results of these two experiments indicate that for late blight control under West Virginia conditions one must both grow late-blight-resistant varieties and spray with a fungicide. The number of applications may be reduced, however. A fungicide is necessary for control of early blight and to keep down late blight due to different races of the fungus. Indications are that some of the organic fungicides may be substituted for the copper materials and thus decrease yield reduction due to copper toxicity.

Scab

Scab is not serious in most of the potato-growing sections of West Virginia, since most of the soil is naturally acid. However, a scab plot is maintained for testing segregating seedlings for scab-resistance. Seventy-four single-hill selections from several segregating families containing resistance to scab were tested this year. Where both blight resistance and scab resistance were in a single family, only those selections previously showing resistance to late blight were planted in the scab garden. Of these 74 seedlings, 19 of them were susceptible to scab. Those showing resistance will be tested again next year.

Other Disease

Preliminary work on some of the virus diseases and ring rot was conducted for the purpose of becoming familiar with them so that methods of testing segregating seedlings for resistance can be carried out.

WEST VIRGINIA

K. C. Westover

The greater part of the potato-improvement work done during the last year by the Department of Horticulture has been carried on at the Reedsville Experiment Farm. A small isolated planting at Bismark, W. Va., (high altitude), intended for the maintenance and increase of stocks resulting from several years' selection was destroyed (with the exception of two or three resistant varieties) by a very early infestation of late blight. With the assistance of the extension specialist working with this crop eight small plantings were made in widely separated potato-growing communities in the medium altitude of the central and southern parts of the State to compare Kennebec with either Katahdin or Sebago which are, at present, the most used late varieties in the State. In all cases, Kennebec substantially outyielded the check varieties, the differences being markedly greater where late blight was present.

Twelve of the adapted established varieties and 10 high-yielding stocks of desirable plant and tuber characteristics, the majority of which carried disease resistance, were compared in the replicated trials at Reedsville. West Virginia table 1 gives the results of the test and suggests that those varieties having resistance to late blight or those that matured early yielded most. July and August were extremely cool and wet which permitted only intermittent spraying to combat an exceptionally early infestation of late blight. Estimates of the percentage of foliage destroyed by blight made in early August are in agreement with the results shown in West Virginia table 1.

The 50-foot row planting was made up of 44 selections from the 1949 10-hill unit planting. They originally came from trial samples or family lines bred for type as well as for disease resistance by the Beltsville Station. About 20 selections are retained to test for disease resistance in the greenhouse.

Fifty-one selections based on adaptability, plant and tuber characteristics, and disease resistance were made from the 173 10-hill units planted. These were closely checked with Sebago and Cobbler. Most of the selections were originally from selections sent from Beltsville or were selected here from Beltsville (B2433, B2346, B2352 and B2574) family lines carrying resistance to one or more of the prevalent potato diseases of this section. These, too, will be checked for disease resistance in the greenhouse before they are again planted.

Twelve family lines (1,015 seedlings) from Beltsville carrying resistance to scab, late blight, ring rot, virus A, and blackleg alone and in combination, and 17 lines (1,910 seedlings) from Iowa bred for scab resistance were also planted. One hundred eighty-three selections, many of which seemed to resist late blight, were made. These, together with other stocks from the pathology department, are now being tested under greenhouse conditions for disease resistance and will be planted in the 10-hill unit trials this season.

Heretofore, potato-improvement work here has been primarily selection based on stock adaptability, desirable plant and tuber characteristics, and disease resistance to a lesser degree. Added trained personnel now makes possible a change in this sequence and offers the possibility of first screening the majority of the selections for disease resistance with a view to more quickly acquiring better breeding stocks and varieties.

W. Va. table 1. Yields in bushels per acre from 1950 replicated potato variety trials, Reedsville Experiment Farm, Reedsville, W. Va.

Variety	Source	Yield per Acre U.S. #1	Off-grade	Rating
		Bu.	Pct.	
Essex	Penna. Cert.	731	6.8	3
Kennebec	U.S.D.A.	588	11.0	16
Menominee	Michigan Cert.	534	6.2	2
Kennebec	Tuber Indexed	518	4.6	1
Dakota Red	Tuber Indexed	515	8.2	7
Pontiac	Michigan Cert.	513	9.3	12
Sebago	Canadian Cert.	513	6.8	3
Chenango	New York Cert.	513	9.7	14
BN-5	Tuber Indexed	501	11.1	17
Cobbler	Canadian Cert.	499	9.4	13
BP-7	Tuber Indexed	493	7.6	5
ND 148-84	Tuber Indexed	477	10.0	15
Cobbler	Tuber Indexed	470	12.1	19
Snowdrift	New York Cert.	460	8.9	10
Chippewa	Canadian Cert.	439	8.7	9
Sebago	Tuber Indexed	434	9.0	11
B738-17	Tuber Indexed	429	4.6	1
B606-37	Tuber Indexed	410	7.3	4
Houma	New York Cert.	407	15.4	21
B47205	Tuber Indexed.	400	8.3	8
B608-55	Tuber Indexed	390	9.0	11
X494-1	Tuber Indexed	338	11.3	18
Katahdin	Canadian Cert.	334	8.00	6
ND K-5	Tuber Indexed	280	12.5	20
B616-17	Tuber Indexed	246	36.5	22
Least significant difference at 5% level		118.6	110.9	
Least significant difference at 1% level		119.6	168.0	

Tuber indexed stocks carried over here

WISCONSIN

R. W. Hougas

Potato Introduction and Preservation Station

Title: Introduction, prevention, classification, distribution, and preliminary evaluation of wild and cultivated species of Solanum.

Agent-in-charge: R. W. Hougas. (Cooperative project supported by the States of the northeastern, north-central, southern, and western regions, and U.S.D.A., Division of Plant Exploration and Introduction.)

Importance of the Problem and Objectives: The primary contribution of the project is in providing a reservoir of valuable genetic stocks that are readily available to potato breeders of the nation. A further contribution is in providing a large host range for pathological and entomological studies. Such studies, in turn, provide valuable information and tools for the breeders' use in improving the potato.

Plan of Work: One of the major hazards of maintaining Solanum tuber lines is loss through virus infection. The experience of many workers has clearly demonstrated that propagation under glass is undoubtedly the best insurance against loss from this cause. With this information at hand, an effort is being made to provide adequate facilities for propagating a portion of all stocks under glass at the Potato Introduction and Preservation Station. During the past year some of the stocks were grown in the greenhouse.

As with many other crops, true seed of Solanum has some definite advantages over vegetative propagation in the preservation of germ plasm. Therefore, in addition to maintenance of the original stock vegetatively, seed will be collected, where possible, from each introduction. This seed, properly stored, will provide added insurance against loss of valuable germ plasm.

Location: The operations of the Potato Introduction and Preservation Project are conducted at two locations. Through summer and fall the major emphasis is centered upon obtaining true seed and tuber increase in the field. Most of this work is done at Sturgeon Bay, Wis. During the winter and spring, the operations of the project are located at Madison, Wis. Introductions that do not tuberize or set seed in the field are increased in the greenhouse. Tuber stocks are indexed for virus content during the winter.

Results to Date: A total of 369 Solanum introductions from 13 countries, have been received by the Introduction Station. The full polyploid series, diploid, triploid, tetraploid, pentaploid, and hexaploid, is represented. Although only a relatively small segment of the introductions on hand have been evaluated, several stocks have been found to possess valuable economic characteristics. The following attributes have been found and reported by research workers at various stations:

a. Immunity or resistance to viruses (A, X, Y and leaf roll).
b. Immunity or resistance to late blight.
c. Resistance to insects (aphids, leafhoppers and Colorado potato beetles).
d. Resistance to frost.

Descriptive notes were made on all introductions grown in the field at the Introduction Station. Herbarium specimens and fruits of several introductions were collected and shipped to Dr. D. S. Correll of the Division of Plant Exploration and Introduction, who is completing a taxonomic study of the stocks now on hand.

An excellent crop of true seed was obtained in the field during the 1950 growing season. An inventory of the available seed and tuber stocks has been prepared and will be distributed to potato breeders and other workers interested in the breeding and improvement of potatoes. This inventory includes information pertinent to the stocks listed.

Arrangements to introduce a substantial portion of the large Commonwealth Potato Collection, especially stocks that have been evaluated and shown to possess characters of value to the potato breeder, are being made

WISCONSIN

G. H. Rieman

---

1. Project Title: Project No. 566--The improvement of quality and disease resistance of the potato, and a study of the methods whereby this can be accomplished by breeding. Causes of potato blackening upon boiling. (Plant Path., Econ. Ent., Biochem, and Hort. Coop.).

2. Project Leaders: G. H. Rieman, Henry Darling, J. C. Walker, R. H. Burris, Russell Larson, and T. C. Allen.

3. Importance of the Problem: Scab is responsible for greater losses in the production of potatoes in Wisconsin than any other single factor. Potato growing is being discontinued in many of the older important production areas due to the inroads of the scab disease.

4. Object: (1) To develop high quality disease-resisting varieties of potatoes with special reference to resistance to scab; (2) to study the cytogenetic basis of sterility and crossability; (3) to determine the value for breeding of commercial varieties and seedlings from this country and abroad, as well as strains and species of tuber-forming Solanums; (4) to evaluate breeding stocks and new varieties in relation to yield, table quality with special reference to blackening after cooking, disease resistance, and market quality; (5) to determine the methods by which the hereditary characteristics of the potato of greatest economic significance may be most efficiently isolated from varietal complexes through which they are scattered and combined in one or more strains.

5. Plan of Work:

   A. Hybridization in greenhouse and selfing in northern Wisconsin breeding plots.

      1. Development of superior varieties.
      2. Development of superior parental stocks.

   B. Screening for important attributes in the greenhouse, laboratory, and breeding plots.

   C. Adaptation tests in various parts of the State.

   D. Maintenance and increase of disease-free breeding stocks in northern Wisconsin.

   E. Exchange of breeding stocks with other research laboratories.

6. Location: Madison and Rhinelander, Wisconsin.

7. Results to Date: See annual reports.

Potato Variety and Advanced Generation Selection Trials in Wisconsin During 1950

Interest in new potato varieties in Wisconsin centers around scab resistance and superior red color. The new Ontario and Russet Sebago varieties are increasing in popularity because they are resistant to scab and produce satisfactory yields. The new Red Pontiac or Dakota Chief is also increasing in popularity because it has a superior red color and produces exceptionally high yields. There is considerable interest in the new Kennebec variety but sufficient seed has not become available for extensive commercial trials. Acreages of the Russet Burbank variety have been increased under irrigation on upland soils and without irrigation on muck soils. The renewed interest in this standard variety is due to its high table quality and resistance to scab.

The advanced generation selection Wis. 303-40 listed in Rieman tables 1 and 2 has consistantly produced high yields and medium scab resistance during

Rieman table 1. Yields in bushels per acre for 23 potato varieties and advanced selections grown at Antigo, Wis., during 1950 1/

Rank	Variety	Season	Yield per acre U.S. No. 1
			Bu.
1	Red Pontiac	L	511
2	Pontiac	L	465
3	Russet Rural	L	453
4	303-40	L	449
5	Triumph	E	432
6	Chippewa	M	428
7	Ontario	L	427
8	Essex	L	426
9	Kennebec	L	420
10	Red Warba	E	413
11	Russet Sebago	L	409
12	K5	E	402
13	Sebago	L	385
14 1/2	M304	L	368
14 1/2	Katahdin	L	368
16	Lake	L	357
17	Irish Cobbler	E	356
18	M303-4	L	350
19	M804	L	347
20	M439	M	327
21	M330	L	315
22	Russet Burbank	L	298
23	Progress	M	296

1/ Trials conducted on Powell Farm
Four randomized blocks, 25 hills per plot. Plot size 3 ft. x 25 ft. L.S.D. (.05) = 37 bu. per acre U.S. No. 1 size.

Rieman table 2. Scab indices and yields in bushels per acre for 16 potato varieties and advanced selections grown at Antigo, Wisconsin, during 1950. 1/

Rank	Variety	Scab index 2/	Yield per acre
			Bu.
1	Hindenburg	23	469
2	M330	34	460
3	Ontario	35	523
4	M804	37	489
5	M439	38	424
6	303-4	39	503
7	303-40	43	561
8	Del. 20	51	535
9	M304	52	528
10	Del. 61	53	513
11	Del. 17	54	511
12	Del. 21	54	496
13	Russet Burbank	54	394
14	Del. 15	55	532
15	Del. 7	62	620
16.	Irish Cobbler	74	409

1/ Trials conducted on Igl farm. Four randomized blocks, 25 hills per plot. Plot 3 ft. x 25 ft.

2/ Scab index = Number of tubers in classes 1, 2, 3, 4, 5, multiplied by 0, 1, 2, 3, 4, respectively. Sum of these products divided by the product of 4 times the number of tubers. This quotient multiplied by 100 = scab index.

the past 3 years. Wis. M330 and Wis M439 selections have exhibited high scab resistance and high specific gravity. M439 usually ranks with Chippewa in the medium maturity class. The scab resistance of the parental Hindenburg variety exceeds the Ontario variety and 12 advanced-generation selections listed in Rieman table 2. These results emphasize the complexity of the inheritance of scab resistance in the potato.

Clonal Variations in the Chippewa Potato Variety

Reported by G. H. Rieman, Henry Darling and R. W. Hougas
(In cooperation with Melvin Rominski, Starks Farms, Rhineland, Wisconsin 1/)

Several hundred advanced-generation clonal selections of Chippewa have been grown annually at Starks Farms and the University Potato Seed Farm for about 12 years. Constant selection for desirable vine and tuber types, as well as for yield, has been practiced. A considerable wealth of material has been developed in both programs showing obvious variations from the normal. Retrogressive changes, as well as favorable changes, have occurred in the variety, and they are apparently quite stable.

The following contrasting characters have been observed in clonal lines of the Chippewa variety:

	Normal	Variant
1.	pigmented blossom	White blossom
2.	green leaves	Yellow-green leaves
3.	medium leaves	Small leaves
4.	medium leaves	Thick leathery leaves
5.	medium vine	Dwarf vine
6.	medium vine	Prostrate vine
7.	medium maturity	Early maturity (2 weeks)
8.	medium maturity	Late maturity (2 weeks)
9.	smooth tuber skin	Russet tuber skin
10.	flat oval tubers	Round tubers

The Chippewa strain XF was produced on the University seed farm. Inoculation tests on Nicotiana rustica and N. tobacum indicated that this clonal line was free from the latent-mosaic virus. Similar tests demonstrated that all of the other Chippewa clonal lines carried various mild strains of the latent mosaic virus. This phase of the investigation is being carried forward and will be reported at a later date.

The yielding ability of 16 Chippewa strains listed in Rieman table 3 was tested in field plots at Starks, Wisc. The yield tests were made during the 1948, 1949, and 1950 seasons. Each strain was grown in 6 randomized blocks, 30 hills per plot.

Favorable cultural conditions were maintained in the test plots as indicated by better than average potato yields for the region. Yields ranged from high of 577 bushels per acre for the Starks 20 strain in 1948 to a low of 392 bushels per acre for the Starks 9 strains in 1950. Ten of the 16 Chippewa strains listed in Rieman table 3 were tested over a period of 3 years. The yield data for these 10 strains show that significant differences in yielding ability occurred each year and that the various strains maintained their rank reasonably well over the 3 year period. The high-yielding Starks 20 strain placed first three times, while the low-yielding Starks 5 strain placed tenth, ninth, and eighth. The balance of the strains varied from 1 to 3 places in rank. If the 10 strains under consideration are divided in half it will be noted that the 5 highest-yielding strains produced yields of over 500 bushels per

1/ In charge of seed development for Starks Farm, Rhinelander, Wis.

acre in 13 out of 15 trials, whereas the 5 lowest-yielding strains produced yields of less than 500 bushels per acre in 13 out of 15 trials. The least significant difference figure of 34 bushels per acre obtained for the 3-year average yields of the 10 strains indicates that the 2 groups of strains differed in their yielding ability.

Rieman table 3. Yields in bushels per acre for 16 Chippewa strains grown at Starks, Wis. during 1948, 1949, and 1950.

Strains	Yield U.S. No. 1 tubers per acre 1/			
	1948	1949	1950	3 year Average
	Bu.	Bu.	Bu.	Bu.
Starks 20	577	550	550	559
" RC	567	519	516	534
" 2	550	519	523	531
" 46	534	546	470	516
" 1	517	543	464	508
Strain M1	489	473	484	482
" E	494	478	460	477
" W	513	464	423	466
" N	501	478	407	462
Starks 5	479	469	425	458
Strain M2	466	445	-	
Starks 9	-	523	392	
" 12	-	503	-	
" 14	-	527	546	
" WB	-	546	552	
Strain XF	-	-	469	
L.S.D.	39	62	72	34

1/ Yield tests were planted in 6 randomized blocks, 30 hills per plot.

Clonal selection within commercial potato v rieties is widely practiced in the development and maintenance of superior seed stocks. It is now well established that two important objectives can be accomplished by this method, namely, elimination of (1) disease and (2) undesirable plant types of unknown origin.

The old problem of potato degeneration has received a pathological interpretation during the past 40 years. During this period the spectacular relationship between virus diseases and the "running-out" troubles of potatoes has obscured the fact that the malady has never been completely accounted for.

The following statement made by Salaman in England in 1926 can be applied at the present time: "To return, however, to the varieties as we know them, it cannot be denied that most, however good in their day, last no more than about twenty five years. To this general rule there are, however, some notable exceptions." Degeneration phenomena variously referred to in seed improvement programs throughout the country as slow, weak, or unproductive types have appeared regularly. Attempts to associate certain reductions in vigor with causal agencies have frequently been unsuccessful. Material of this kind is usually discarded. The clonal selection program with the Chippewa variety described in this report tends to show that these unproductive variants are heritable and that their occasional appearance is the rule and not the exception in asexual potato propagation. Therefore, the clonal selection method may not only be a valuable tool for the control of disease but also a valuable tool to maintain varieties at high levels of production by eliminating deleterious variants of genetic orgin.

The Occurrence of Mycorrhiza-like Mycelium in Potato Tubers

G. H. Rieman, D. C. Cooper, and R. W. Hougas

Mycorrhiza-like mycelium was first noted in potato tuber tissues during the winter of 1943. At that time microscopic examinations of tissues from tubers showing spindle sprout were made. A fungal growth associated with the phloem parenchyma was observed in all the tubers examined and attempts were made to culture the organism. Standard laboratory procedures commonly used to isolate pathogenic organisms were employed. These attempts to isolate the causal organism were unsuccessful, and the study was discontinued. Similar fungal growths were found in nine potato tubers showing internal physiological necrosis during the fall and winter of 1950. Four unrelated, healthy-appearing tubers were also examined and found to be infested with a similar fungal mycelium. A preliminary experiment was carried on in the greenhouse with plants grown from the nine infected tubers showing internal physiological necrosis and the four infected unrelated, healthy-appearing tubers. Two plants were grown from each tuber in light, sandy soil. One plant of each pair was grown to maturity in a cool greenhouse held at temperatures ranging from 60° to 65° F., and the other member of each pair was grown to maturity in a hot greenhouse held at temperatures ranging from 75° to 80° F. Low soil moisture conditions were maintained to favor the development of internal physiological necrosis. No internal necrosis was observed in the tubers produced by the 26 plants. However, all of the plants produced tubers infected with a mycorrhiza-like mycelium. These findings prompted a shift in interest from the two non-parasitic maladies of the potato under consideration to the prevalence and nature of the mycorrhiza associations.

Mention may here be made to Bernard's theory (1911) that the formation of tubers is, in general, dependent on the presence of fungi, and that the tuberous habit is a direct consequence of fungal infection. This theory meets with difficulties in the case of the potato since it is widely held that the cultivated species are not so infected.

Certain strain(s) of fungi come in contact with the growing tip of a stolon of the potato during the course of its development. The fungus penetrates the growing tip and comes to be associated with the phloem parenchyma. Shortly thereafter tuberization is initiated. A preliminary test has been made wherein 18 plants were grown from true seeds in vermiculite supplied with a nutrient solution and distilled water. All of the plants produced numerous stolons but in only one instance was a tuber formed although other stolons were present on that plant. The tuber was examined and found to be infected with a fungus. This finding suggests that infection occurred from some outside source rather than that the fungus was associated with embryo development.

An examination of a number of varieties and strains of potatoes from Wisconsin and seven other potato-producing States has revealed the presence of a fungus in the apical portions of the tubers in all instances.

The results suggest that most, if not all, potatoes grown in the United States are infected with a mycorrhiza-like fungus. There is also the implication that these mycorrihiza associations in the potato may be the cause of tuberization.

WYOMING

Wm. A. Riedl, G. H. Starr, and Clarence M. Rincker

The work at the Wyoming Agriculture Experiment Station consisted of testing new seedlings for scab and ring rot resistance, testing new varieties and promising seedlings for adaptability, yield and cooking quality.

Ring Rot Studies

Nine ring rot resistant seedling varieties were tested for resistance again this year in 10-hill rows replicated 4 times. All varieties except one remained free of ring rot symptoms throughout the season. One new seedling (P1160188) obtained from the Sturgeon Bay, Wis.,Potato Introduction Station remained free of ring rot symptoms for the second year. The Bliss Triumph check in this trial had 84 percent of the plants showing ring rot symptoms.

In another trial 19 new varieties and promising seedlings were tested for ring rot resistance in 10-hill rows replicated 4 times. These varieties ranged from 25 to 92 percent of the plants showing ring rot symptoms.

Forty-seven new seedlings received from the Nebraska Experiment Station and the Sturgeon Bay Introduction Station in 1950 were tested for ring rot resistance in 10-hill rows without replication. None of these showed any resistance to ring rot.

Tubers infected with ring rot from nine ring rot resistant varieties were planted in 10- and 40-hill rows. Six varieties showed no ring rot symptoms, while three varieties showed a few questionable ring rot infected plants. Teton and seedling W420 showed no ring rot in 38 and 32 plants, respectively, from the 40 infected seed pieces planted.

This appears to indicate that even though naturally infected seed is planted certain resistant varieties have the ability to produce plants free from ring rot symptoms. Bliss Triumph checks similarly planted had 100 percent of plants showing ring rot symptoms. Tubers from the resistant varieties have been saved and will be checked for ring rot infection. It is planned to plant these again next year and to check the stems for the ring rot bacteria.

Effect of inoculum. Experiments were continued in 1948, 1949, and 1950 using inocula from four infected varieties to inoculate healthy tubers of the same four varieties in all combination. These varieties were the Teton, resistant; Bliss Triumph, susceptible; and two intermediate varieties, Burbank and Red McClure. As an average of the 3 years' results, the inoculum taken from Burbank tubers caused the most ring rot (83 percent) and also the greatest severity (5.0) in the varieties tested. Other inocula gave the following results: Bliss Triumph, 74 percent and 4.2 severity; and Teton, 72 percent and 4.2 severity. (In the severity index, 10 = complete breakdown, 0 = no ring rot symptoms) .Considering the separate tests during the 3 years, the Burbank inoculum gave the greatest percentage and severity of infection in five tests; the Red McClure inoculum was most virulent in three tests; the Bliss Triumph inoculum most virulent in two tests, while the Teton inoculum was not the most virulent in any of the tests.

Dilution of inoculum. In 1946 tests were begun to determine how much the bacterial inoculum could be diluted and still cause plant symptoms to develop during the current season. The basic inoculum referred to as "Full Strength" was diluted 1:10, 1:100, and 1:1,000 in 1946; diluted similarly but to 1:10,000 in 1947; diluted to 1:100,000 in 1948 and diluted to 1:1,000,000 in 1949 and 1950. The "Full Strength" bacterial suspension was prepared by using 7.5 grams of bacterial ooze, squeezed from infected tubers, to 250 c.c. distilled water.

In 1946 ring rot symptoms appeared at 1:100 and below but not at 1:1,000; in 1947 and 1948 symptoms appeared at 1:1,000 and below but not when diluted more; in 1949 symptoms appeared at the 1:100 series but not at 1:1,000; while in 1950 ring rot appeared in all of the dilution-series up to and including 1:1,000,000. Also, in 1950 the disease was more severe and the symptoms showed up earlier than in any previous year since the tests began. In 1949 ring rot symptoms were first seen in the field plots on August 16, and by August 30 some plants were completely broken down; however, in 1950 the first symptoms were seen on August 7, and some of the plants were completely broken down by August 14.

The 1950 season was a very cool one; June was unusually dry, while July was unusually wet. In all, the conditions were extremely favorable for ring rot plant symptoms to develop. Because of the favorable season many of the potato lots that had been inoculated with trace amounts of bacteria the previous year and earlier, developed ring rot symptoms during 1950.

Streptomycin for ring rot control. Three lots of Bliss Triumph seed were used and treated with streptomycin 1:100 in water. These were (1) surface-inoculated cut seed pieces (healthy); (2) naturally-infected, cut seed; and (3) naturally-infected, whole seed.

In the surface-inoculated lots treated for 30 and for 60 minutes, no ring rot was found indicating complete control. In the naturally-infected cut seed treated for 1 and for 5 hours the stands were reduced greatly. With the naturally-infected whole seed treated for 5 hours and for 12 hours there was some evidence of control. The check had 66 percent ring rot; the 5-hour treatment, 55 percent; and the 12-hour treatment, 17 percent ring rot.

These experiments confirm the findings of earlier greenhouse tests that streptomycin is effective in the control of surface ring rot infection and to a degree the reduction of natural infection in whole tubers.

Scab Resistance Test

During the 1950 season, 90 varieties and lines were tested for scab resistance at the Agronomy Farm, Laramie. This material was planted in 5-hill units and replicated three times in randomized trials. The lines tested included potatoes from Colorado, Iowa, Nebraska, Wyoming, and the U. S. Department of Agriculture.

The degree of scab infection was not as severe as that usually found but was sufficient to evaluate the material according to scab pustule type. The following lines were selected for further testing, having good scab resistance and satisfactory type and yield: W461 (627-8), W471 (528-118), W2107 (B395-5), W2116 (6317)*, W2121 (C.6364)*, W2129 (Ia.116-13)*, W2138 (C.6332)*, W2140 (104-2)*, W2191 (C.7918), W2323 (4700)*, W2351 (9799), W2354 (10184), W2357 (Ia.44-33-2)*, W2362 (Nebr.24.38-3), W2369 (Nebr.105.42-1), W2377

(Nebr. 311.43-1), W2378 (Nebr.151.44-4), W2414 (P.I.160194), W2417 (B395-5), W2418 (B395-13), W2420 (C.6324), W2422 (C.6332), W2424 (6403), W2425 (7137), W2426 (7287), W2427 (7308), W2431 (7803),

* Outstanding lines.
1 Now a named variety - Yampa.

W2434 (7702), W2436 (8043), W2437 (8053), W2438 (7846), W2439 (9727), W2441 (9741)*, W2442 (9760), W2447 (10185), W2447A (M63-11), W2474 (Nebr.120.40-6), W2477 (Nebr.38.42-3), W2478 (Nebr.140.42-1), W2482 (Nebr.213.43-3), W2483 (Nebr.217.43-1), W2484 (Nebr.225.43-1), W2485 (Nebr.311.43-1), W2486 (Nebr. 60.44-1), W2489 (Kennebec), BT x 471.

Of these lines, 29 were white and 17 were red. The units with an asterisk were especially good.

Variety Yield Trials

Eighteen varieties were tested for yield in 60-hill rows replicated 4 times. Results are shown in Wyoming table 1.

Wyoming table 1. Potato variety trial, Laramie, Wyoming - 1950

Variety	Total yield per acre	U.S. No. 1 Per acre	Rank U.S. No. 1	U.S. No. 1
	Bu.	Bu.		Pct.
White Rose	524 -	444 *-	1	85
Pontiac	517 -	394 **	5	76
Red McClure	511 -	427 *-	3	84
Seedling W2107	487 -	433 -	2	89
Bliss Triumph	477 -	305	15	64
Seedling 4756	459	415 **	4	90
Seedling 627-103	446	383 *-	6	86
Progress	442	278	17	63
Russet Rural	435	369 *-	8	85
Kasota	430	344	11	80
Yampa	429	348	10	81
Chippewa	422	373 *-	7	88
Pearl	420	318	13	76
Cobbler	402	312	14	76
Teton	397	352	9	89
Katahdin	370	339	12	92
Red Warba	360	290	16	81
Burbank	354	251	18	71
Difference required for Significance (5% point)	63	53		

* Significantly higher than Bliss Triumph
\- Significantly higher than Cobbler.

Previous crop - Summer Fallow
One-row plots, 60 feet long, 1 x 3 feet; four replications.
Planted May 22, 1950.
Harvested October 4 and 5, 1950.

Seedling Yield Trials

Four seedling yield trials were conducted at Laramie in 1950. Twelve seedlings were tested in 60-hill rows replicated 4 times. Nineteen seedlings were tested in 60-hill rows without replication. Seventeen seedlings were tested in 60-hill rows replicated 3 times. Twenty-two seedlings were tested in 25-hill rows without replication. In all these trials the Bliss Triumph variety was used as a check. Thirty-seven seedlings out of 70 tested yielded more potatoes than Bliss Triumph. Many of these have commercial possibilities and will be tested again next year.

Seedling Increase

Fourteen promising seedlings were increased at Laramie. Eight promising seedlings were increased at the Torrington Station. Three of these were discarded.

Seedling Observation

Seventy-two seedlings were planted in an observation trial consisting of four-hill rows. Sixty-eight seedlings were saved for further increase.

First-year Seedlings

One hundred sixty seedling lines were grown. Approximately 200 selections were made. These will be tested for resistance to ring rot and scab in 1951.